SELF-EFFICACY AND COMPLIANCE AMONG HEMODIALYSIS PATIENTS

By

WILLIAM RAPHAEL SMITH

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SELF-EFFICACY AND COMPLIANCE
AMONG HEMODIALYSIS PATIENTS

By

William Raphael Smith

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Chairman: Carolyn M. Tucker, Ph.D.
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Non-compliance to the hemodialysis treatment regimen is a widespread problem which results in increased patient morbidity, mortality, and health care costs. Self-Efficacy Theory may provide a useful framework from which to understand non-compliance to the hemodialysis regimen and thus facilitate the development of effective strategies to improve compliance. During Phase 1 of this study the Patient Self-Efficacy Questionnaire (PSQ) was administered to 29 outpatient hemodialysis patients and 1-week and 1-month stability coefficients of r = .80 and r = .70, respectively, were obtained. Self-efficacy (SE) measures were significantly related to average daily interdialysis fluid weight gain (r = -.39 to r = -.33), BUN (r = -.41 to r = -.35), and bicarbonate level (r = .44 to r = .47). Selected patient characteristics generally were not related to SE or compliance measures. In Phase 2, 19 non-compliant patients from Phase 1 were randomly assigned to 1 of 3 groups that either

1. self-monitored and recorded fluid intake daily,
2. received treatment 1 plus feedback on the relationship between fluid intake and fluid weight gain and were praised by dialysis unit staff for decreases in fluid weight gain, or
3. received routine dialysis treatment (control group).

Repeated measures analyses of variance demonstrated no group, treatment versus non-treatment, time, or interaction effects on average daily fluid weight gain. Visual analyses of graphs of fluid weight gain data showed no treatment effect across time for all but 1 subject. Although group means of SE did not change across time, changes in SE were associated with changes in average daily fluid weight gains for individual patients ($\underline{r}$ = -.64 to $\underline{r}$ = -.20). It was concluded that

1. The PSQ provided reliable measurement of SE of non-compliant hemodialysis patients.
2. SE measures were related to compliance measures and changes in SE measures were associated with changes in compliance, consistent with SE Theory.
3. The interventions utilized in this study were ineffective in altering SE and compliance to fluid restrictions of non-compliant patients.

CHAPTER I
INTRODUCTION

At a cost of over 2 billion dollars per year, more than 72,000 renal failure patients are kept alive, most of them on hemodialysis (Chyatte, 1979; Fortner-Frazier, 1981; Greenspan, 1981; "Dialysis Population," 1984). Althogh patient survival is not the problem it once was due to major technological advances and gradual refinements in the hemodialysis process, patient quality of life has become a significant concern. Quality of life is a multifaceted phenomenon (Blodgett, 1981-1982) consisting of several dimensions including vocational rehabilitation (Armstrong, 1978; Kaplan De-Nour, 1981), sexual adjustment (Finkelstein, Finkelstein, & Steele, 1976; Procci, 1984; Thurm, 1975), family adjustment (Dress & Gallagher, 1981; O'Brien, 1980), compliance to the medical regimen (Blackburn, 1977; Cheek, 1982; Yanitski, 1983), and psychological adjustment (Mlott & Allain, 1974; Pritchard, 1974a; 1974b; 1974c; Towne & Alexander, 1980). All of these factors are ultimately affected by the patient's physiological status which is, in turn, dependent on the effectiveness of the hemodialysis process (Czaczkes & Kaplan De-Nour, 1978). The major factor that negatively impacts the hemodialysis process, the patient's physiological status and quality of life is non-compliance to the medical regimen.

Safe and effective hemodialysis treatment requires patients to adhere to a restricted diet (devoid of many familiar and favorite foods), a severe restriction in the amount of liquid allowed, and the consistent use of several

medications (Oberley & Oberley, 1975). Both patients and dialysis health care professionals agree that adherence to these treatment restrictions is exceedingly difficult (Kaplan De-Nour & Czaczkes, 1972; Tucker, Chennault, Ziller, Huber, Blake, & Finlayson, 1986). This consensus is objectively supported by data reported in the literature which indicate that rates of compliance to fluid and dietary restrictions and medication use have ranged from 7% to 86% with compliance rates across studies averaging 50% to 80% (Blackburn, 1977; Cheek, 1982; Cummings, Becker, Kirscht, & Levin, 1982).

The potential medical consequences of non-compliance to hemodialysis treatment restrictions are varied and potentially life-threatening. The most frequently mentioned include stroke, heart failure, bone disease, fatigue, nausea, vomiting, muscle cramps and weakness, hypertension, impaired memory, and cognitive deficits (Czaczkes & Kaplan De-Nour, 1978). These complications are responsible for more frequent and extended hospitalizations which result in increased health care costs. In addition to increased morbidity, chronic and/or extreme non-compliance can lead to death. Despite the potential severity of the consequences of non-compliance, a significant number of hemodialysis patients, nevertheless, do not adhere to their diet, fluid, and medication prescriptions. In addition, anecdotal evidence suggests that these high rates of non-compliance persist despite concerted efforts by patients and dialysis unit staffs to improve adherence to treatment restrictions.

It has become evident that progress toward a better understanding of compliance and improvement of patient compliance has been hindered by inadequate models of compliance (Haynes, Taylor, & Sackett, 1979). Although the Health Belief Model (HBM), proposed by Rosenstock (1966) has been applied successfully to compliance to medical regimens, recent evidence

suggests that it does not adequately predict compliance to the hemodialysis treatment regimen (Cummings et al., 1982; Olsen, 1983; Yanitski, 1983).

Self-Efficacy Theory, as recently proposed by Albert Bandura (1977a, 1982, 1984), may prove useful in enhancing our understanding of compliance and thereby aid researchers in developing more effective interventions to improve compliance. Briefly, Self-Efficacy Theory maintains that behavior is determined primarily by 2 factors--outcome expectations and efficacy expectations. Outcome expectations refer to individuals' beliefs that behaviors or sets of behaviors will prove effective in achieving a desired goal or outcome. Efficacy expectations refer to individuals' beliefs concerning their abilities to successfully implement the behaviors in question. Bandura (1977a) has demonstrated that when outcome and efficacy expectations are high, individuals are likely to engage in a particular behavior.

It is important to note that self-efficacy, as explained by Bandura, is situation and behavior specific. An individual may have high self-efficacy with respect to a specific behavior in a particular situation and low self-efficacy for that same behavior in another situation. Also, a given individual may have different levels of self-efficacy for different behaviors. For example, a patient may be very self-efficacious in a wide range of social situations but may have low self-efficacy with respect to compliance to fluid restrictions associated with hemodialysis treatment.

Self-Efficacy Theory has proven useful in the understanding and prediction of a wide range of health related behaviors including smoking cessation and relapse (Coletti, Supnick, & Payne, 1985; DiClemente, 1981; Marlatt & Gordon, 1980), pain perception and management (Neufield & Thomas, 1977; Reese, 1982), dental phobias (Klepac, Dowling, & Hauge, 1982),

childbirth pain (Manning & Wright, 1983), arthritis pain (Turk, Meichenbaum, & Genest, 1983), eating disorders (Chambliss & Murray, 1979; Love, 1983), cardiac rehabilitation (Ewart, Taylor, Reese, & DeBusk, 1984), and exercise adherence (Kaplan, Atkins, & Reinsch, 1984). Based on these encouraging reports, Self-Efficacy Theory may prove valuable in enhancing our understanding of compliance to the hemodialysis treatment regimen.

A survey of the literature reveals that 3 classes of interventions have been either proposed or utilized to alter patient compliance to medical regimens. These include psychotherapy of various types (e.g., Abram, 1968; 1969; Crammond, Knight, & Lawrence, 1967; Daly, 1970; Fried, Danks, & Beavert, 1976; Halper, 1971; Kaye, Leigh, & Straugh, 1973; Lefebvre, Norbert, & Crombez, 1972; Marshall, 1974; Newmann, 1983; Schlebusch & Levin, 1982; Shea, Bogdan, Freeman, & Schreiner, 1965), patient education (e.g., Bass & Wilson, 1964; Glogow, 1970; Haefner & Kirscht, 1970; Radelfinger, 1965), and behaviorally based approaches (e.g., Azrin & Powell, 1969; Cummings, Becker, Kirscht, & Levin, 1981; Magrab & Papadopoulou, 1977; Starfield, Sharp, & Mellits, 1971). Behavioral interventions have been shown to be more effective in improving compliance in a wide range of medical regimens than either counseling or patient education approaches (Epstein & Cluss, 1982; Haynes, 1976). In light of the magnitude and seriousness of the non-compliance problem in hemodialysis patients, the encouraging results of previous research on Self-Efficacy Theory and health related behaviors, and the relative success of behaviorally based interventions to improve compliance, the author proposes the following:

1. to develop an instrument to measure self-efficacy with respect to fluid compliance in hemodialysis patients.
2. to investigate the relationship of self-efficacy and compliance in hemodialysis patients.
3. to investigate the effects of 2 behaviorally based interventions on self-efficacy and compliance in hemodialysis patients.

CHAPTER II
REVIEW OF THE LITERATURE

Compliance to Treatment Regimens

Definition of Compliance

The most basic issue involved in the study of compliance is the definition of the term. Authors define and operationalize compliance to suit their own purposes and with respect to the context in which they are operating. Haynes (1979) has defined compliance in a way that captures the essential features common to most definitions of compliance. He defines compliance as "the extent to which a person's behavior (in terms of taking medications, following diets, or executing life style changes) coincides with medical or health advice" (pp. 2-3). Other researchers have added cognitive components to their definitions by requiring compliant patients to know the names and purposes of their medications (Becker, Drachman, & Kirscht, 1972; Nessman, Carnahan, & Nugent, 1980).

The term "adherence" has been used interchangeably with the term "compliance" (Gordis, 1979; Sackett & Haynes, 1976). An ongoing discussion has arisen wherein the relative merits of each term have been argued. Masur (1981) has argued that the term "adherence" is more appropriate because it suggests an egalitarian relationship between health care provider and patient. In contrast, the term "compliance" connotes an unequal relationship between an authoritarian provider and a subservient patient. Althogh this author

finds merit in Masur's argument, the terms will be used interchangeably in this paper as has become customary in the literature.

Methodological Issues in the Measurement of Compliance

Related to the foregoing discussion of the definition of compliance is the issue of how to differentiate compliant from non-compliant patients. Gordis (1976) states that the ideal cut-off point should be biologically based. Thus, non-compliance should be operationalized to be the point below which adverse effects occur or the therapeutic effect lost. Unfortunately, this approach is rarely seen in the literature. Gordis (l976) describes the alternatives typically utilized by researchers in compliance research. Many investigators divide the population into compliant and non-compliant groups on the basis of a statistical criterion. For example, a researcher might determine the median compliance level for a particular sample of patients and label those above the median, compliant, and those below, non-compliant. This approach has the advantage of maximizing subgroup size but has the disadvantage of having neither biological or behavioral significance.

A second approach for operationalizing non-compliance involves treating compliance as a continuous variable. This avoids the task of arbitrarily defining levels at which a behavior will be considered compliant or non-compliant. While this approach may be suited to some purposes, such as determining the relationship between levels of compliance and various patient characteristics, it may be unsuited to other purposes, such as the identification of non-compliant patients for a study investigating interventions to improve non-compliance.

There are two other classes of methodological issues associated with the study of compliance. The first is that of sampling procedure or how

patients are selected for the compliance research. The central issue involved here is whether the sample of patients selected for the study accurately represents the population from which it was drawn. Most studies of compliance to treatment regimens are cross-sectional in nature and include only those patients treated for a particular problem (Sackett & Snow, 1979). In addition, of those currently being treated for a particular condition, only those individuals willing to participate are included in the study.

Epstein & Cluss (1982) strongly suggest that patients who volunteer to participate in research may be quite different in motivation and other characteristics that might make them unrepresentative of the patient population as a whole. In fact, evidence suggests that levels of compliance for clinic patients are higher than that of the general patient population because grossly non-compliant patients select themselves out of treatment altogether (Haynes, 1976). Sackett & Snow (1979) maintain that all compliance studies should utilize an incipient cohort that includes both those who continue and those who drop out of treatment. This tactic allows researchers to ascertain compliance rates more realistically because drop outs are considered when determining rates of compliance and non-compliance. This concern may be less relevant in the present study because the consequences of dropping out of hemodialysis treatment are so great (death within a short period of time).

Another major issue in compliance research is reliable measurement of compliance. Gordis (1976) characterizes methods for the measurement of compliance as either direct or indirect.

Direct measures of compliance include determining serum or blood levels of the prescribed medication and measuring urinary excretion of either the drug or a metabolic by-product. Tracers placed in the medication may

also be assayed in blood or urine samples to determine rates of compliance. Masur (1981) considers direct measures of compliance to be the most objective and accurate available. Direct observation of behaviors representing compliance are also included in this category. Although direct methods of ascertaining compliance are certainly the most accurate, they are not without problems. Based on his review of the compliance literature, Gordis (1976) lists several factors which must be considered when utilizing direct compliance measurement techniques including the excretion pattern of the drug or its metabolites and the reactivity of the measurement procedure.

Indirect methods of compliance measurement include patient self-report, therapeutic outcome, physician estimate of compliance, pill and bottle counts, and mechanical methods of monitoring compliance. These methods and the problems associated with them have been widely discussed in the literature and thus will be summarized.

Patient self-report involves asking patients whether they have engaged in the required compliance behaviors (e.g., taking a required medication). Unfortunately, the preponderance of evidence strongly suggests that patients and their family members can be very unreliable sources of compliance information as they consistently over-estimate their level of compliance or that of a family member (Bergman & Werner, 1963; Francis, Korsch, & Morris, 1969; Gordis, 1976; Gordis, Markowitz, & Lilienfeld, 1969; Park & Lipman, 1964; Rickels & Briscoe, 1970; Sheiner, Rosenberg, Marathe, & Peck, 1974).

The use of therapeutic outcome as a compliance measure often occurs in research. Inherent in this measure is the assumption that the treatment if followed as directed will be effective. Although there is evidence in support of this notion (Kutt, Haynes, & McDowell, 1966; Markowitz, 1970), Masur (1981)

cites evidence which indicates that therapeutic outcome may be an unreliable indicator of compliance due to the effect of extraneous variables, such as other treatments occurring simultaneously, psychosocial factors, diagnostic inaccuracy, and the remission of the illness unrelated to treatment.

In clinical settings, physicians' judgments concerning patient compliance have been trusted measures of compliance. Evidence suggests that this confidence in physician estimates of compliance is not well founded (Caron & Roth, 1968; Charney, 1972; Davis, 1968; McClellan & Cowan, 1970; Mushlin, 1972; Mushlin & Appel, 1977; Paulson, Krause, & Iber, 1977). For example, Caron & Roth (1968) compared the judgments of 27 hospital residents concerning 525 of their patients' compliance with urine analysis data. Twenty-two of the residents overestimated compliance with an average error of 32%.

Pill and bottle counts have often been used to measure compliance. This method involves comparing the amount of medication remaining after a period of time with that which would have remained if the medication were taken as prescribed. In addition to the inherent inability to monitor patterns of non-compliance with this method, pill and bottle counts are easily falsified by patients who simply discard unused medication prior to assessment (Gordis, 1979). As a result the unusually high rates of compliance reported by studies relying solely on pill and bottle counts (Mattar, Markello, & Yaffe, 1975; Moulding, 1961; Tinkelman, Vanderpool, Carroll, Page, & Spangler, 1980) have been criticized (Epstein & Cluss, 1982).

Medication usage has also been measured using mechanical, electronic, and photographic monitoring devices such as medication monitors (Moulding, Onstad, & Nugent, 1970; Norell, 1979). Although these devices

accurately record the number and time sequence of pills removed from their containers, they cannot assure that the medication is actually ingested by the patient. Gordis (1976) maintains that medication monitors are expensive and offer little advantage over simple pill and bottle counts.

All methods of compliance measurement are subject to limitations and must be used carefully, taking into account the compliance behaviors and patient population in question. The most appropriate assessment strategy is characterized by the use of more than one method of measurement, preferably utilizing at least one direct or objective method.

Consequences of Non-compliance to the Medical Regimen

Non-compliance to medical regimens can have serious consequences to the health of patients. General consequences of non-compliance to therapeutic regimens include exacerbation of the condition and progression of the disease, more frequent and serious medical emergencies, unnecessary prescriptions of more potent and/or toxic medications, failure of the treatment, more frequent hospitalizations and, even, death (Czaczkes & Kaplan De-Nour, 1978; Epstein & Cluss, 1982).

The Extent and Magnitude of the Compliance Problem

Despite the serious consequences which can accompany non-compliance, a large number of patients fail to adhere to their treatment regimens. In her review of 50 studies completed prior to 1970, Marston (1970) found that compliance varied widely, ranging from 4% to 92%, depending on the medical regimen, patient population, measurement technique, and compliance criterion employed in the study. Epstein and Cluss (1982) cited studies reporting compliance rates of 18% to 89%. Sackett and Snow (1979) suggest that the average rate of compliance across studies of short-term

treatment regimens, such as 10-day antibiotic medication regimens, is 62%. It is impressive that 38% of patients do not adhere even to treatments that require little behavioral change over a relatively short period of time. Therefore, it is not surprising that compliance rates for long-term preventive and therapeutic regimens is even lower. Sackett and Snow (1979) report compliance rates for long-term preventive regimens of 33% to 84% with a mean of 57%. They also report compliance rates for long-term treatment regimens of 41% to 69% with a mean compliance rate of 54%.

Non-compliance is not an isolated problem restricted to a relatively small number of medical conditions but is a pervasive problem in a large number of conditions. Non-compliance to medical regimens has been reported for a wide range of patients including 44% of hospitalized peptic ulcer patients (Roth, Caron, & Hsi, 1970), 58% of diabetic and congestive heart failure patients (Hulka, Cassel, Kupper, & Burdette, 1976), 47% of Canadian steelworkers using anti-hypertension medication for 6 months (Sackett, Haynes, Gibson, Hackett, Taylor, Roberts, & Johnson, 1975), 50% of Veterans Administration Hospital Gastrointestinal Ward inpatients (Caron & Roth, 1971), and 3l% of elderly nursing home residents (Hemminki & Heikkila, 1975). Many other studies reporting similar rates of medication non-compliance have been reported (Davis, 1971; Gibberd, Dunne, Handley, & Hazelman, 1970; Gordis, Markowitz, & Lilienfeld, 1969; Hare & Wilcox, 1967; Hedstrand & Aberg, 1976; Moulding, Onstad, & Sbarbaro, 1970; Schwartz, Wang, Zeitz, & Gross, 1962). Clearly, non-compliance to treatment regimens is a wide-spread and significant problem.

Factors Influencing Compliance to the Therapeutic Regimen

The majority of studies of compliance to the therapeutic regimens have focused on factors that are thought to influence patient compliance. Haynes (1976, 1979) has exhaustively reviewed these studies and has categorized them as follows: demographic features of the patient, features of the disease, features of the therapeutic regimen, features of the therapeutic source, features of the patient-therapist interaction, and socio-behavioral features of the patient. To exhaustively review this literature is beyond the scope of this dissertation, and peripheral to its main focus; therefore, only a brief summary of each area will be presented

Demographic features of patients

In reviews of 185 studies completed prior to 1973, Haynes (1976, 1979) concluded that patient age, sex, educational level, occupation, income, marital status, socioeconomic status, ethnicity, and religious affiliation are generally unrelated to compliance to the therapeutic regimen. For example, 7 studies found a positive relationship between age of the patient and compliance, whereas 30 studies which examined that relationship found that they were not significantly related. For the other demographic variables studied, the ratio of studies finding no relationship with compliance to those that did was at least 2 to 1. Other reviewers have reached similar conclusions regarding the relationship between demographic variables and compliance (Blackwell, 1973; Gillum & Barsky, 1974; Marston, 1970; Mathews & Hingson, 1977; Stone, 1979).

Haynes (1976) cautions, though, that most of the studies he reviewed are clinically based and may reflect biases toward the inclusion of certain types of patients (compliant) and the exclusion of others (non-compliant).

Prospective community-based studies and studies involving single disease groups frequently report positive and significant relationships between patient demographic variables and compliance. Masur (1981), in the context of his review of the compliance literature, states that demographic factors may be predictive of compliance for specific populations, treatments or disease entities despite the lack of a significant relationship overall. In this same vein, Haynes (1976) also believes that other evidence supports the notion that patient demographic variables determine access to health care services but do not predict compliance for individuals once they gain access to the health care system.

Features of the disease

Features of the disease, such as diagnosis, severity of the illness, duration of the illness, number of occurrences of the illness, previous occurrence of the illness recency of last episode of illness, previous hospitalizations, length of hospital stay, previous therapy, degree of disability caused by illness, and number and type of symptoms associated with the illness are generally unrelated to compliance to the therapeutic regimen (Haynes, 1976, 1979). Of the 42 studies reviewed in this area, only 14 showed any of the preceding factors to be significantly related to compliance. For the majority of disease related factors, the preponderance of evidence is against the existence of a systematic significant relationship with compliance. The one notable exception is within a specific population; compliance to medication use among psychiatric patients appears to be related to diagnosis (Haynes, 1976).

Features of the therapeutic regimen

In contrast to the areas previously mentioned, there appears to be a clear relationship between some features of the therapeutic regimen and compliance to that regimen. Type of medication, degree of behavioral change required to adhere to the treatment regimen, complexity of the regimen, duration of the regimen, and side-effects associated with the regimen appear to be related to compliance (Haynes, 1976, 1979).

The degree of behavioral change required of the patient to be compliant to the treatment regimen appears to be inversely correlated to compliance. Thus, passive cooperation to procedures done for or to patients is most easily secured. Participation of patients in regimens requiring active involvement is less easily obtained. Level of compliance also is dependent on the type of behavior change required of patients. For example, compliance in situations requiring patients to acquire new habits (e.g., taking medications) is easier to obtain than compliance in situations which require alteration of well learned, pre-existing behaviors (e.g., adhering to a diet), which is easier than obtaining patient compliance for cessation of personal habits or dependencies (e.g., cessation of cigarette smoking or alcohol use) (Haynes, 1976).

Of the 16 studies reviewed by Haynes (1976), 12 showed a significant negative correlation between complexity of the therapeutic regimen and compliance. He believes that this finding is explained by the relationship discussed previously--the degree of behavioral change required of the individual is inversely related to the compliance exhibited by that individual. Complex regimens typically require greater behavioral change on the part of patients and thus patients are compliant less often and to a lesser degree (Masur, 1981).

The results of studies investigating the relationship of duration of therapy to compliance are mixed. Some studies (e.g., Glick, 1965; Ireland, 1960) have found an inverse relationship; others (e.g., Bender, 1972; Porter, 1969) found no association. If one carefully examines the studies in question, an explanatory pattern emerges. Those studies finding no relationship between duration of treatment and compliance utilized patients who had been undergoing treatment for at least six months. In contrast, studies finding an inverse relationship between compliance and duration of treatment used patients who were just beginning their treatment. It is likely that in the former studies non-compliant patients had selected themselves out of the patient sample before the study had begun, whereas in the latter group of studies non-compliant patients were dropping out during the course of the study. It is likely, then, that the differences found between these two groups of studies can be explained by the patient samples utilized. The general conclusion to be drawn from the preceding discussion is that compliance is inversely related to duration of treatment with lower compliance being associated with longer duration of treatment.

The relationship of the side-effects associated with treatment regimens and compliance is not clear. Some studies (e.g., Caldwell, Cobb, Dowling, & de Jongh, 1970; Weintraub, Av, & Lasagna, 1973) report an inverse relationship between occurrence and/or severity of medication side-effects and compliance, whereas other studies (e.g. Glick, 1964; Willcox, Gillan, & Hare, 1965) have found no association between side-effects and compliance. Melamed and Seigel (1980) observe that, although research findings are equivocal on the relationship between side-effects and compliance, clinical evidence suggests that patients are less compliant to medications which have

significant side effects, especially when the medical conditions for which they are receiving treatment have minimal symptoms.

Features of the therapeutic source

Several features of the therapeutic source have been investigated including the therapist's and interviewer's prediction of patient compliance, whether a particular physician treats a particular patient, assignment of patient to a physician versus patient choice of physician, regular versus substitute physician, clinical convenience, clinic waiting time, referral to private physician versus referral to a clinic, and time between screening and referral appointment (Charney, Bynum, Eldredge, Frank, MacWhinney, McNabb, Scheiner, Sumpter, & Iker, 1967; Jonas, 1971; Rickels & Briscoe, 1970). Of all these factors only clinic waiting time has been consistently related to compliance, where compliance was measured by appointment keeping rather than compliance to the medical regimen, per se (Alpert, 1964; Davis, 1968).

Features of the patient-therapist interaction

Stone (1979) has argued that the interaction between patient and health care provider is an important determinant of compliance to the therapeutic regimen. Much of the available research has focused on the patient-provider communication process. Evidence suggests that the health care provider as a source of information to patients about what medications they are to take, when they are to take them, and in what dosage they are to be taken, is a contributing factor in patient non-compliance (Boyd, Covington, Stanaszek, & Cousons, 1974; Ley, 1977; Ley & Spelman, 1967; Mazzulo, Lasagna, & Griner, 1974). For example, Ley, Bradshaw, Eaves, & Walker (1973) showed that patients treated in general medical practice had forgotten 50% of the statements made to them within 5 minutes of seeing their physician and that

diagnostic related statements were remembered better than instructions about health care behaviors (Ley, 1972). The importance of health care providers communicating instructions clearly to patients and ascertaining whether these instructions are understood by patients cannot be over-emphasized. Svarstad (1976) reported that patients with completely accurate recollections of physician instructions were three times as compliant as those who made one or more errors in recall.

Socio-behavioral features of the patient

Diverse factors, such as patient understanding of treatment and health beliefs are included under the rubric, socio-behavioral features of the patient. The relationship of these variables to treatment compliance will now be highlighted.

Surprisingly, patients' knowledge of their diseases or treatments appear unrelated to their compliance to the therapeutic regimen (Haynes, 1976). Masur (1981) comments that although patients must remember the physician's directions in order to be compliant, this in no ways guarantees patients will follow them. Patients may possess all necessary personal resources to remember instructions and follow through on them, but nevertheless, choose to disregard them.

Compliance to one aspect of the therapeutic regimen has been associated with compliance to other aspects of the therapeutic regimen, as has been previous compliance to the therapeutic regimen and current compliance to the same regimen (Haynes, 1976). This trend, though, is not found with hemodialysis patients as will be discussed in a subsequent section.

Influence of family and friends, as well as family stability, also appears to be associated with compliance to therapeutic regimens (Haynes, 1976).

Family size, however, is not associated with compliance (Francis, Korsch, & Morris, 1969; Neely & Patrick, 1968).

A distinct literature has developed around the relationship of health beliefs to patient compliance. Specifically, the Health Belief Model (HBM), developed by Rosenstock (1966) and modified by Becker (1974), has generated considerable interest and research activity. The HBM postulates that compliance is determined by four factors: the perceived severity of the illness or disease, the perceived susceptibility of the patient of contracting the disease or developing medical condition, the perceived barriers to and costs of compliance to the regimen versus the perceived benefits of compliance, and the presence of a cue to action that motivates the patient to engage in the compliance behavior. It is important to note, that according to the Health Belief Model, compliance is determined by the individual's beliefs about compliance not the objective reality of the situation or behavioral alternatives.

Early research supported all aspects of the model (Haynes, 1976), although prospective studies (Becker, Maiman, Kirscht, Haefner, & Drachman, 1979) have generally found weaker relationships between health beliefs and compliance than retrospective studies. This trend may indicated that changes in compliance may precede rather than follow alteration in patient health beliefs (Masur, 1981).

Haynes, Sackett, & Taylor (1979) and Sackett & Snow (1979) have reviewed the extensive literature generated by the HBM and concluded that the overall pattern of findings is mixed and that further research and refinement of the model is necessary.

Strategies to Improve Compliance to Medical Regimens

There are four basic approaches utilized to improve compliance to medical regimens. They are

1. Patient Education
2. Counseling
3. Behavioral Approaches
4. Mixed Approaches using a combination of strategies.

Each will be reviewed in turn.

Patient education approaches to improve compliance

As was noted in an earlier section of this literature review, there appears to be no systematic relationship between patient knowledge of illness or medical regimen, educational level or intelligence and compliance to the medical regimen. It is somewhat surprising, then, to see that several studies have found that educating patients about their illness and appropriate health care measures to be effective in helping to improve patient compliance (Barnes, Gunther, Jordan, & Gray, 1971; Bass & Wilson, 1964; Glogow, 1970; Rosenberg, 1971). Other studies, though, have failed to show any relationship between compliance or therapeutic outcome and educational strategies (Evans, Rozelle, Lasater, Dembroski, & Allen, 1970; Haefner & Kirscht, 1970; Radelfinger, 1965).

Counseling approaches to improve compliance

Neufield's (1976) suggestion that educational strategies are ineffective for the improvement of patient compliance because they fail to address attitudes seems to be supported by research investigating the effectiveness of individual and group counseling to improve compliance. A variety of health care providers, including physicians (Porter & McCullough, 1972), physician

assistants (Vidt, 1978), nurses (Romankiewicz, Gotz, Capelli & Carlin, 1978), and pharmacists (Schneider & Cable, 1978) have utilized counseling to help improve patient compliance. Haynes (1976), though, reports that of the six studies conducted prior to 1972, only one study showed that counseling was effective in aiding patients to be more compliant.

More recent evidence indicates that counseling may in fact be an effective compliance improving intervention, either when used alone or as a part of a multi-component treatment program. Garb & Stunkard (1974) found that 29% of the patients who participated in a self-help counseling group were able to adhere to their diets and reach their 20 pound weight loss goal and that 8% of the patients in the group were able to meet their 40 pound goal. In another study involving 36 patients with a high risk of cardiovascular disease, nine 15-minute individual counseling sessions were more effective in helping patients modify risk factors when compared to a medical consultation only control group (Meyer & Henderson, 1974). Hovell, Geary, Black, Kamachi, and Hirk (1984) found that lay counseling of 10 non-compliant patients with hypertension was associated with an increase in medication compliance from 69% to 84% as measured by pill counts. Although two of the three studies just cited did not utilize control groups, they do provide some evidence that counseling may be effective in improving compliance.

One observation is appropriate here. Because the descriptions of the counseling interventions utilized in the studies reported in the literature are typically minimal, it is difficult to ascertain the exact nature of the effective interventions. In order to more clearly evaluate the effectiveness of counseling to improve patient compliance, future studies should include clear and

complete descriptions of the counseling interventions implemented as well as use larger samples and more carefully controlled research designs.

Behavioral strategies to improve compliance

Whereas educational strategies attempt to improve compliance by providing patients with accurate information about their medical regimens and traditional counseling interventions attempt to modify attitudes and motivation to improve compliance, behavioral approaches attempt to alter compliance behavior directly. There are five basic behavioral approaches represented in the literature:

1. tailoring the medical regimen to the individual
2. cueing
3. self-monitoring and self-recording
4. reinforcement
5. multi-component behavioral programs.

Tailoring the medical regimen to the individual patient. Tailoring the medical regimen to the individual refers to the process of fitting the medical regimen prescribed by the physician to specific characteristics of the patient (Dunbar, Marshall, & Hovell, 1979). Specific examples of alterations in the therapeutic regimen that illustrate the process of tailoring include adjusting medication dosage schedules to fit eating habits, offering the therapy in the most palatable form for patient, using a single dose rather than multiple dosages, using easy to read directions and easily opened containers, and packaging multiple medications in one packet to simplify medication taking (Masur, 1981).

Numerous studies have shown the common sense approach of tailoring to be effective in improving compliance (Atkinson, Gibson, & Andrew,

1978; Hallburg, 1970; Haynes, Sackett, Gibson, Taylor, Hackett, Roberts, & Johnson, 1976; MacDonald, MacDonald & Phoenix, 1977; Norell, 1979). Perhaps the strongest evidence for the effectiveness of tailoring the regimen to individual requirements of patients comes from a meta-analysis conducted by Posavack, Sinacore, Brotherton, Helford, & Turpin (1985). They evaluated 96 educational and behavioral interventions utilized in 58 different studies and found that tailoring the treatment regimen produced the largest mean effect size for improving compliance.

Cueing. Cueing is the provision of discriminative stimuli which may trigger compliance behaviors or remind individuals to engage in compliance behaviors. Medication charts and calendars (Gabriel, Gagnon,& Bryan, 1977; Liberman, 1972; Moulding, 1961; Schwartz, 1965), medication monitors (Moulding, 1979), medication dispensers with automatic audio cues (Azrin & Powell, 1969), and telephone or postcard reminders (Larson, Olsen, Cole, & Shortell, 1979) have been shown to be effective cues for the improvement of patient compliance to medical regimens. Dunbar, Marshall, & Hovell (1979) conclude that, although there is limited evidence available concerning the effectivenss of cueing to improve patient compliance, it may be especially effective in improving compliance in patients with problems remembering their medication schedules.

Self-monitoring and self-recording. Although self-monitoring was initially utilized as a data collection procedure, its reactivity soon prompted investigations utilizing it as an intervention to alter behavior (Kanfer, 1970; Kazdin, 1970). The effectiveness of self-monitoring to help individuals alter behavior has been demonstrated with a wide range of behaviors, although there is little agreement concerning why it is effective in altering behavior

(Mace & Kratchowill, 1985; Nelson & Hayes, 1981). Target behaviors that have been investigated include agoraphobic behavior (Taylor, 1985), hallucinations (Rutner & Bugle, 1969), hair pulling (Bayer, 1972), repetitive motor behaviors (Hutzell, Platzek, & Logue, 1974; Matetzky, 1974; Thomas, Abrams, & Johnson, 1971), reports of paranoid ideation (Williams, 1976), and symptoms of depression (Harmon, Nelson, & Hayes, 1980).

Some studies (e.g., Johnson & White, 1971; Mace & Kratchowill, 1985; McFall, 1970) have shown that self-monitoring is effective in helping individuals improve compliance and other behaviors, whereas other studies have failed to show that it is an effective intervention to improve compliance (Carnahan & Nugent, 1975; Epstein, Beck, Fiqueros, Farkas, Kazdin, Daneman, & Becker, 1981; Johnson, Taylor, Sackett, Dunnett, & Shinizu, 1978). When one examines these and other studies (Epstein & Masek, 1978; Wandless & Davie, 1977), it becomes apparent that self-monitoring of symptoms appears to be less effective than self-monitoring of medication or target behaviors. Also, self-monitoring of blood pressure, when used as the only intervention, is generally ineffective in reducing blood pressure, but self-monitoring of anti-hypertensive medication usage is generally effective in improving compliance (Goldstein, Shapiro, Thanovopavarin, & Sanbhi, 1982; Johnson et al., 1978; Laughlin, Fisher, & Sherrard, 1979). These facts may help explain why major reviews have reached different conclusions concerning the effectiveness of self-monitoring to improve compliance. For example, Masur (1981) and Dunbar, Marshall, & Hovell, (1979) conclude that self-monitoring appears to be effective in helping patients improve compliance to treatment regimens, whereas Epstein & Cluss (1982) state that there is little evidence in support of the effectiveness of self-monitoring.

The fact that these reviewers reach different conclusions can be explained in part by the following:

1. Different studies were reviewed in each.
2. Self-monitoring is not an invariant phenomena but a variable response that interacts with the behavior being monitored. The effectiveness of self-monitoring may vary with the behavior being monitored, when the monitoring occurs, and the procedure used to self-monitor (Bellak, Rozensky, & Schwartz, 1974). It appears that the effectiveness of self-monitoring must be determined for a particular behavior exhibited by specific patient populations.

Barlow (1976) suggests that the effectiveness of self-monitoring as a behavioral intervention can be maximized when the following conditions are present:

1. Patient is motivated to change.
2. Behavior being self-monitored is easy to discriminate.
3. Recording materials are easy to use.
4. Patient is thoroughly instructed on how to self-monitor.
5. Recording occurs in close proximity to the behavior.
6. Feedback is provided to the patient.
7. Patient knows self-report will be checked for accuracy.

Reinforcement. Interventions utilizing reinforcement of compliance related behaviors have generally been effective (Epstein & Cluss, 1982). Epstein et al. (1981) instructed parents to reinforce their diabetic children's compliance to diet and medication usage according to individually negotiated behavior contracts. The use of verbal and material rewards resulted in a

reliable increase in the percentage of urine tests showing no sugar from 27% during baseline to 45% at follow-up. In a single group outcome study, Bigelow, Strickler, Liebson, and Griffiths (1976) utilized deposit-refund contracts to reinforce Antabuse intake in 20 male alcoholics. Patients were abstinent from alcohol and compliant for Antabuse use over 95% of the treatment days which was significantly longer than they had been in the past. Steckel & Swain (1977) used written contracts which specified reward contingencies to help patients lose weight. Average weight loss for the individuals in the contract group was 6.2 pounds over 18 months, whereas no patients in the no contract group lost any weight.

The previously mentioned studies involved the provision of reinforcement from external sources. Other studies have shown that self-administered reinforcement can be effective in improving target behaviors. For example, Bowers, Clement, Fantuzzo, and Sorensen (1985) demonstrated that a group of six, 8-to-11-year-old boys with attention deficits improved twice as much in their attention spans when they self-administered their reinforcers as when the rewards were administered by a teacher. Although this study did not involve compliance to the medical regimen, it illustrates that self-reinforcement can be a powerful modifier of behavior. Most studies utilizing self-reinforcement of compliance behaviors have not used it as the sole intervention, but rather have used it as a part of a multi-component package. Self-reinforcement in this context will be considered in the next sections.

Multi-component behavioral packages. Multi-component progams have often proven effective in improving patient compliance, although unfortunately, the research designs utilized in the studies documenting their effectiveness have limited determination of the relative effectiveness of each

component (Epstein & Cluss, 1982). For example, Jacob, Fortman, Krasemer, Farquhan, and Agras (1985) investigated the effect of a behavioral treatment package which included relaxation therapy, dietary modifications, and contingencies of reward and punishment on compliance to treatment regimen and blood pressure of 60 hypertensive patients. The authors found that, although the package produced an increase in compliance and a decrease in weight, the treatment group did not differ significantly in weight loss or compliance from a matched control group who followed a simple program of medication usage. It appeared that in this case the additional components of the package did not significantly increase compliance and weight loss over that achieved by a much simpler, basic medical treatment. Where possible, studies investigating the effectiveness of multi-component packages should utilize research designs that allow for analyses of the effects of each component included in the package.

Comparison of Treatment Effectiveness Among Intervention Strategies to Improve Compliance

After reading the foregoing sections, the clinical researcher is prompted to ask which interventions are most effective for improving compliance to the medical regimen. Answering this question is not easy and the answers obtained not clear cut.

Haynes (1976) and Posavac et al. (1985) attempt to answer this same question but proceed in different ways. Haynes (1976), in his review of 44 studies published prior to 1973 that used either educational (including counseling), behavioral or a combination of intervention approaches, tallied the number of studies showing an improvement in compliance and/or clinical outcome for each type of intervention used. Educational approaches were

least effective, resulting in improvements in compliance in 65% of the reviewed studies and improvements in clinical outcome in 50% of the studies. Behavioral approaches used alone resulted in improved compliance in 85% of the studies reviewed and resulted in improved clinical outcome in 75% of the studies. Combined behavioral and educational intervention approaches resulted in improved compliance in 88% of the cited studies with improvement in clinical outcome observed in 75% of the studies. The more complex educational/behavioral programs appear to offer no advantage over purely behavioral programs.

Posavac et al. (1985), using meta-analysis, determined the effectiveness of 96 interventions to improve compliance utilized in 58 studies. Their findings parallel those of Haynes (1976); behavioral interventions generally produced the largest treatment effects with tailoring the medical regimen possessing the largest mean effect size among the behavioral interventions.

Other studies have investigated more specific comparisons among various behavioral interventions which were designed to improve compliance. For example, Mahoney (1974) randomly assigned 49 obese adults to one of four treatment groups: self-monitoring of food intake, self-reinforcement for weight loss, self-reinforcement for decreased food intake, and delayed treatment control group. All groups started with self-monitoring which produced brief and variable weight loss. When self-reinforcement was added significant and lasting weight loss occurred with those self-rewarding decreases in food intake showing greater weight loss than those self-rewarding weight loss.

In another study, Mahoney, Moura, & Wade (1973) also found that self-reinforcement was superior to self-monitoring of weight loss. When

self-punishment was added to the self-reward treatment, it produced the greatest weight loss at the end of treatment and follow-up. Two other studies (Mann, 1972; Romanczyk, 1974) show a similar pattern of results. Self-monitoring is effective in helping patients reduce their weight, but when self-reinforcement is added significantly larger weight losses are observed.

The preceding review of the literature has clarified some issues concerning the effectiveness of treatment interventions to improve compliance. Behavioral interventions are the simplest and most effective for improving compliance. While it is not possible to identify definitively the most effective behavioral interventions, self-reinforcement appears to be more effective than self-monitoring. In addition, there is significant evidence that cueing and tailoring the treatment regimen to the individual are effective in helping patients improve compliance. Further research is necessary to investigate the effectiveness of specific behavioral packages on compliance in specific patient populations. The need for this type of research is indicated by evidence that suggests that behavioral interventions may be differentially effective in improving compliance to medical regimens among various patient groups and target behaviors.

Compliance to the Hemodialysis Treatment Regimen

The Kidneys, Kidney Disease, and Treatment Modalities

Each human normally has two kidneys which are located just above the pelvis in the small of the back. Each kidney is shaped like a kidney bean and is about the size of an adult's fist. Typically each kidney is composed of approximately one million nephrons. Nephrons are the functional units of the kidney and are responsible for the filtration of the body's waste products.

The kidney has several functions in addition to its well known job of removing metabolic waste products from the body. They help control blood pressure by producing a potent chemical substance called renin which, even in minute quantities, can cause great increases in blood pressure (Quinones, 1983). The kidneys also produce hormones such as erythropoiten which stimulate the bone marrow to produce red blood cells.

Kidney failure can result from any of the four major kinds of kidney disease: glomerulonephritis, pyelonephritis, hypertensive kidney disease, and polycistic kidney disease (Fortner-Frazier, 1981). Systemic diseases, such as arteriosclerosis, diabetes milletus, systemic lupus erythematosis, gout, and Wilm's tumor, as well as environmental toxins, can also damage kidneys (Fortner-Frazier, 1981). When kidney function decreases to 5% of its normal level, a diagnosis of End-Stage Renal Disease (ESRD) is made.

Presently there are three major treatment modalities for treating ESRD patients. They are renal transplantation, Continuous Ambulatory Peritoneal Dialysis (CAPD), and hemodialysis. None cure the disease, per se, but all at least replace the filtering function of the kidneys.

Renal transplantation involves the grafting of a donor kidney into the vascular system of the transplant recipient (Steinberg, Levy, & Radvilla, 1981). If the immunosuppressant drug therapy is successful and the transplanted kidney is not rejected by the body's immune system, then the kidney functions as any normal kidney would. Ideally, this is the most satisfactory modality for the treatment of ESRD because all normal kidney functions are performed by the transplanted kidney.

In 1978, Popovich, Moncrief, and Nolph reported the development of a new form of dialysis--Continuous Ambulatory Peritoneal Dialysis (CAPD).

CAPD is a process by which approximately two liters of hypertonic dextrose dialysate is instilled into a patient's peritoneal cavity via a surgically implanted catheter in the patient's abdomen. The dialysate inside the peritoneal cavity comes into contact with the peritoneal membrane where impurities generated by metabolism and excess fluid can cross the peritoneal membrane from the blood stream into the dialysate where they can be removed. The dialysate is changed three to five times per day by the patient at home using a sterile exchange procedure.

Today, as well as in the past, the majority of ESRD patients in the U.S. have been maintained on hemodialysis at a cost of approximately 20,000-40,000 dollars per year per patient (Chyatte, 1979; Fortner-Frazier, 1981; Wright, 1981). Hemodialysis is a procedure by which a patient's blood is continuously filtered in an artificial kidney machine. Each treatment is performed for 4-6 hours, 3 times per week. Blood is removed from the patient though an arterio-venous shunt or a fistula, circulated through a hemodialyser, and then returned to the patient (Oberley & Oberley, 1975). Only a small amount of blood is out of the patient's body at any given time.

In no other area of medicine is compliance more critical than in the management of hemodialysis patients. The nature of the hemodialysis process and the resultant physiological states of the patient necessitate strict adherence to fluid and dietary restrictions as well as medication adherence.

Patients must follow a diet that may be restricted in their favorite foods. Foods high in potassium, phosphorous, and salt must be avoided. Fluid restrictions are especially severe with most patients allowed approximately 1000-2000 ml of fluid per day. It is not surprising that hemodialysis patients report that the most difficult aspect of hemodialysis treatment is adhering to

the fluid and dietary restrictions (Kaplan De-Nour & Czaczkes, 1972). Many patients must take several medications as part of the hemodialysis treatment regimen.

Compliance is typically measured by verbal report from patients and by monthly blood testing. Blood levels of potassium, phosphorous, and interdialysis weight gain are assessed. Desirable levels for serum potassium are 3.0-5.0 mEq/l and for serum phosphorous, 3.5-5.0 mg/100 ml (Blackburn, 1977). Interdialysis fluid weight gain is typically restricted; patients are usually allowed to gain from two to four pounds between treatments.

Consequences of Non-Compliance to the Hemodialysis Regimen

If patients are non-compliant to the hemodialysis treatment regimen severe health complications can occur. The potential consequences of non-compliance include stroke, heart failure, bone disease, fatigue, vomiting, muscle cramps and weakness, hypertension, impaired memory, cognitive deficits, and even, death (Czaczkes & Kaplan De-Nour, 1978).

In addition, uremic pericarditis or an inflamation of the membrane surrounding the heart frequently occurs in patients on hemodialysis and is exaccerbated by non-compliance to fluid restrictions (Czaczkes & Kaplan De-Nour, 1978). If this condition becomes chronic, decreased heart function and death can occur.

Hypertension or elevated blood pressure can also result from imbibing more fluid than recommended. Dietary non-compliance in the form of adding salt to food or eating highly processed or salted foods can significantly contribute to hypertension. In many cases diets high in salt and the resulting hypertension originally caused the patient's kidney failure.

In patients who consume excess protein in violation of their dietary restrictions, disequilibrium syndrome can be exaccerbated (Czaczkes & Kaplan De-Nour, 1978). This condition involves deterioration of the patient's clinical condition as evidenced by increasing lassitude, headache, and confusion. Increased blood pressure, heart rate, and respiration rate can accompany severe cases of disequilibrium syndrome, as can pulmonary edema and cardiac arrest.

Renal osteodystrophy or bone disease can occur in hemodialysis patients for many reasons including non-compliance to their phosphate binding medication regimen (Czaczkes & Kaplan De-Nour, 1978). In bone disease high levels of phosphorous accumulate in the blood. The phosphorous replaces the calcium in the matrix of the body's bones, thus weakening its structure and reducing its ability to support the body. Over time bone disease can severely limit activity, cause debilitating pain, and become a major source of disability for the hemodialysis patient.

Chronic non-compliance can result in frequent and extended hospitalizations, increased health care costs, and significant patient discomfort (Epstein & Cluss, 1982). These consequences as well as those previously mentioned can usually be avoided, or at least minimized, by strict adherence to all aspects of the hemodialysis treatment regimen.

Magnitude of the Problem of Non-Compliance to the Hemodialysis Regimen

Borkman (1969) has emphasized that compliance is not a global phenomenon but a multifaceted one where patients may be compliant to one aspect of the hemodialysis treatment regimen but not other aspects. For example, compliance among hemodialysis patients as measured by serum phosphorous levels has been found to be 7% (Cheek, 1982), 62% (Blackburn,

1977), and 30% (Cummings, Becker, Kirscht, & Levin, 1982). In the same studies 33%, 79%, and 86% of the patients, respectively, were compliant according to serum potassium levels. Furthermore, in the same studies, 66%, 49%, and 59% of the patients, respectively, adhered to their fluid restrictions. Not only do these data reflect divergent compliance rates for different aspects of the hemodialysis treatment regimen but they also highlight the variance in reported compliance across studies. This pattern is repeated throughout the hemodialysis compliance literature (Bollin & Hart, 1982; Hartman & Becker, 1978; Procci, 1978, 1981; Yanitski, 1983).

The results of the studies reported in the literature are difficult to compare and interpret because each study utilized different criteria to identify compliant and non-compliant patients. If one computes the average rates of compliance across studies, 73.5% of the patients are compliant according to serum potassium levels, 45.9% are compliant according to serum phosphorous levels, and 60.4% of the patients are compliant according to interdialysis fluid weight gain measurements. Two conclusions are inescapable. Despite differences in reported rates of compliance across studies, non-compliance to one or more aspects of the hemodialysis regimen is a significant problem for many hemodialysis patients. It is also evident that the average patient is not equally compliant to each aspect of the hemodialysis regimen.

Issues in the Measurement of Compliance to the Hemodialysis Treatment Regimen

Measurement of compliance to the hemodialysis treatment regimen is subject to many of the same issues that were raised earlier in this literature review. However, they assume a more specific focus in the present context.

Blodgett (1981-1982) has criticized much of the research on adjustment to hemodialysis on the grounds that researchers have failed to agree on basic definitions and measurement of adjustment. This criticism is equally valid when applied to the hemodialysis compliance literature. For example, Ferraro, Dixon, and Kinlaw (1986), in their review of nine recent compliance studies, found that one or more of the following nine measures were used to measure compliance: serum potassium, serum phosphorous, blood urea nitrogen, creatinine, interdialysis weight gain, diastolic blood pressure, subjective staff ratings, subjective investigator rating, and patient dietary recall. To further complicate comparison of studies, even when researchers utilized the same general measurements, the criteria representing compliance seldom coincided. Ferraro et al. (1986) observe that this lack of agreement on definition and measurement of compliance is primarily responsible for the diversity of results reported in the literature.

Given that agreement on definition and measurement is desirable, and ultimately essential, what should be the standard measurement used? Cheek (1982) maintains that only interdialysis fluid weight gain is a reliable indicator of compliance because various uncontrollable factors can affect serum phosphorous and potassium levels and that these measurements are made only once per month. The same can be said of blood urea nitrogen and serum creatinine levels. Blood pressure can be affected by numerous factors including anxiety level, environmental characteristics and sequellae of kidney failure (Czaczkes & Kaplan De-Nour, 1978). Subjective ratings of compliance by staff in hemodialysis units have been inaccurate due to factors such as preexisting perceptual sets, high levels of stress, and psychological denial (Glassman & Siegal, 1970; Kaplan De-Nour & Czaczkes, 1974; Rhodes, 1981).

Patient understanding and recall of diet has also proven unreliable as an indicator of compliance (Haynes, 1976).

There seem to be at least three solutions to the hemodialysis compliance measurement problem. If only one measure of compliance is used to represent overall compliance, then interdialysis weight gain should be used. It has the advantage of reliability, relative stability from extraneous influences, frequency of measurement, and objectivity. Ferraro et al. (1986) found it to be the most reliable indicator of compliance across studies. Another possible solution proposed by these researchers was the utilization of an index based on multiple determinations of several indicators of compliance. The measurements could be weighted to optimize the reliability of the index.

The third solution is to report compliance rates for each aspect of the hemodialysis treatment regimen. There are several rationales for this approach. Blodgett (1981-1982) argues that adjustment is a multifaceted phenomenon that cannot be adequately represented by a single variable. Compliance rates for different aspects of the hemodialysis treatment regimen can vary considerably (Borkman, 1969). Compliance to each aspect of treatment encompasses different behavior patterns that are only loosely related at best. Since serum potassium, serum phosphorous, and interdialysis weight gain data are routinely collected as part of patient care, they should continue to be used separately as measurements of compliance to diet, medication, and fluid restrictions, respectively. If, for research purposes, one wishes to represent compliance as a single parameter, then either interdialysis weight gain or a composite index should be utilized.

Greater attention should be focused on reaching a consensus concerning standardized criteria (specific numerical values) for operationalizing compliance measures. When one examines the studies reviewed by Ferraro et al. (1986), it is evident that the criteria used to determine compliance to diet and medication use (serum potassium and serum phosphorous) are more standardized than the criteria used to identify compliance to fluid restrictions. Fluid weight gain non-compliance criteria range from two pounds to over five pounds between treatments. Anecdotal evidence suggests that a similar situation exists in clinical practice.

Gordis (1976) makes the case for setting compliance levels according to biological criteria. For example, fluid compliance criteria could be set at a point that allows maximum consumption without deleterious health consequences to the patient. Manley and Sweeney (1985) have addressed this issue in a study of 34 in-center hemodialysis patients. They compared patients who had recent medical problems that were likely associated with non-compliance to fluid restrictions to patients who did not experience these medical complications. Patients with medical complications had an average interdialysis weight gain of 2.22 Kg whereas patients without recent medical complications had an average interdialysis weight gain of 2.47 Kg between treatments. This difference was not statistically significant. The authors concluded that interdialysis weight gains of 2 to 2.5 Kg between treatments should be considered within the range of compliance. Although further research is necessary to confirm this finding, this study represents a major advance in the determination of rational compliance criteria.

Factors Associated with Compliance to the Hemodialysis Treatment Regimen

As was the case within the general compliance literature, researchers have sought to determine factors associated with compliance to the hemodialysis treatment regimen. The factors which have been investigated include demographic variables, psychological characteristics, intelligence, health beliefs, and family related factors. Each of these will be discussed in turn.

Patient demographic factors

The general compliance literature reviewed earlier in this chapter shows little relationship between patient demographic variables and compliance. This pattern is essentially repeated in the hemodialysis compliance literature, though the results are somewhat more mixed. For example, Yanitski (1983) examined the relationships between age, sex, marital status, income, education, and length of time on dialysis and compliance as measured by interdialysis weight gain, serum potassium, and serum phosphorous. She found only 1 statistically significant relationship (education and interdialysis weight gain) out of a total of 36 which she examined. In contrast, Cheek (1982) found significant relationships between age, sex, and marital status and compliance as measured by interdialysis weight gain. Ferraro et al. (1986), in a study of 98 in-center hemodialysis patients, reported that compliant patients were more likely to be older, white, female, and have been on dialysis a short time. They caution, though, that uncontrolled factors such as residual kidney function, type of compliance measure used, and sample of patients included in the study, may be responsible for the measured associations.

Perhaps the most definitive examination of the relationship between patient demographic variables and compliance is that of Olsen (1983). She performed a meta-analysis (Glass, McGraw, & Smith, 1981) of 40 studies

indexed in Psychological Abstracts and Medlars II from 1963 to 1983. She examined the relationships of patient variables including education, IQ, age, sex, marital status, and time on dialysis to adjustment as measured by compliance, vocational rehabilitation, survival, and social adjustment. Only level of education was related to adjustment. Most studies included in the meta-analysis used compliance as the dependent variable with the minority utilizing other dependent variables. For example, of the 14 studies measuring compliance and examining its relationship to age, 10 showed no relationship between the two. For sex and compliance, 12 of the 14 studies showed no relationship. Similarly, for the relationship between marital status and compliance, six of the eight showed no relationship. In general, there does not appear to be a consistent relationship between patient demographic variables and compliance to various aspects of the hemodialysis regimen.

Psychological factors

The relationship of locus of control (Rotter, 1966) and compliance has been extensively investigated. Locus of control refers to the tendency of individuals to perceive their sources of reinforcement as either external to themselves or as internal. Values of 8.0 or less on Rotter's Internal-External Locus of Control Scale indicate an internal locus of control whereas values greater than 8.0 indicate an external locus of control. Individuals with an internal locus of control feel that they are in control of their lives but individuals with an external locus of control feel that they do not control their lives. Yanitski (1983) reported a high positive correlation between internal locus of control and high compliance in hemodialysis patients. Bollin and Hart (1982) found that patients with external loci of control had low compliance to diet, fluid

intake restrictions, and medication. In contrast, Blackburn (1977) found no significant relationship between locus of control and compliance.

The relationships of many other psychological variables to compliance have been investigated. A study comparing the scores of 40 compliant and 40 non-compliant hemodialysis patients using the Tennessee Self-Concept Scale and the Rosenberg Global Self-Esteem Scale found that both groups had above average self-esteem (Basta, 1981). Compliant patients evidenced a tendency to over-emphasize their positive attributes and displayed a greater use of defensive distortion in self-reporting.

Kaplan De-Nour and Czaczkes (1972), using psychiatric interviews of 43 hemodialysis patients, found the following factors were related to poor compliance: low tolerance to frustration, acting out behaviors, denial of the sick role, and suicidal behavior. Yanagida, Streltzer, and Siemsen (1981) reported that denial is high among both compliant and non-compliant patients. Adaptive denial in compliant patients is associated with an internal locus of control, less awareness of the limitations imposed by the illness, and greater independence. The authors suggest that denial in compliant patients helps defend against emotional distress while not interfering with accurate processing of cognitive information.

Cheek (1982), using the Response to Illness Questionnaire (Pritchard, 1974a), found that compliant patients were more accepting of illness, did not blame others for their misfortune, accepted responsibility for their own care, and possessed the ability to cope with the anxiety they felt concerning their illness. Non-compliant patients viewed their illness as an enemy or burden which rendered them powerless. They also felt unjustly afflicted by their illness but comfortable with the sick role. Often they were preoccupied with their

illness yet not involved in their own care. Schlebusch and Levin (1982) also found significant differences between compliant and non-compliant patients on 4 scales of the 16 PF indicating that non-compliers were more expedient, more venturesome, more inclined to experiment, and more likely to exhibit disregard toward procedure and protocol. The 16 PF is an instrument consisting of 16 bipolar scales which describe a wide range of characteristics of the personalities of individuals in the normal range of development.

Intelligence, as measured by the Wechsler Adult Intelligence Scale (WAIS), is indirectly related to compliance, but an understanding of specific compliance behaviors has been found to be more highly correlated with compliance (Borkman, 1976). In contrast, Kirilloff (1981) reported that both compliers and non-compliers possessed substantial information concerning their disease and hemodialysis.

Numerous studies have reported that diverse psychological factors are related to patient compliance to the hemodialysis regimen (e.g., Hall, Root, & Vogel, 1979; Pritchard, 1974a; 1974b; 1974c; Towne & Alexander, 1980). Locus of control has been consistently associated with compliance, whereas the findings concerning other psychological variables have been equivocal (Blodgett, 1981-1982; Olsen, 1983).

Health beliefs

The Health Belief Model (HBM), developed by Rosenstock (1966) and modified by Becker (1974), has been applied to the study of hemodialysis patients' compliance. Briefly, the HBM postulates that compliance is a function of a patient's readiness to act, based on the level of patient motivation, perceived susceptibility to a particular medical condition, perceived severity of the condition, and an estimate of the benefits and barriers to compliance.

Yanitski (1983) tested several hypotheses generated from the HBM and found no relationship between compliance among the 29 hemodialysis patients in her study and health concerns, development of another serious illness, perceived seriousness of the illness, benefits of various aspects of treatment, perceived barriers to compliance, willingness to adopt the sick role and socioeconomic status. In contrast to these results, Bollin and Hart (1982) found that there was a direct relationship between hemodialysis patients' self-reports of health valuing and compliance as the HBM would predict.

Further support for the HBM was obtained by Cummings et al. (1982). They found that beliefs about the benefits of treatment, barriers to treatment, and perception of family problems formed the best set of predictors of compliance to the hemodialysis regimen. No relationship was found between patient understanding of treatment instructions and compliance. The authors concluded that although psychosocial factors can account for 30% of the variance in fluid compliance and 53% of the variance in dietary compliance, situational factors account for the greatest portion of the variance in compliance. Situational factors include being away from phosphorous binding medications at mealtimes, eating out, and forgetfulness. In general the authors concluded that their data did not support the HBM. Olsen (1983) also reports that her meta-analysis failed to find significant relationships between health beliefs and compliance among hemodialysis patients.

Family factors

The role of family factors in affecting patient compliance has also been investigated. Steidl, Finkelstein, Wexler, Feigenbaum, Kitsen, Kleger, and Quinlan (1980) found the following six factors related to adherence to the hemodialysis treatment regimen: family ability to negotiate and solve

problems effectively, strong parental coalition, parental resolution of parental conflicts without involving the children, openness and receptiveness of family members to the opinions of other family members, co-leadership of the family by both spouses, and family members' acceptance of responsibility for their own actions.

Hartman and Becker (1978) found that hemodialysis patients who reported fewer family problems and those who received assistance from their spouses had better compliance to the dietary restrictions associated with hemodialysis. Pentecost, Zwerens, and Manuel (1976) reported that in a group of 40 home hemodialysis patients, compliance with fluid restrictions was positively correlated with the quality of family members' communication. In a study of 55 hemodialysis patients and their families, Sherwood (1983) found that families characterized as understanding, supportive, organized, and neither overly involved nor disengaged were more frequently associated with patient compliance.

Although patient adjustment appears to be important to compliance to the hemodialysis treatment regimen, the spouse's adjustment also appears to be important. Somer and Tucker (in press) found that of patient variables and family conditions examined, the patient's spouse's marital adjustment, as measured by the Locke Marital Adjustment Questionnaire, was the single highest correlate of dietary compliance.

Strategies to Improve Compliance to the Hemodialysis Treatment Regimen

Considerable attention has been directed toward modifying various psychological factors related to compliance. Psychotherapy conducted by psychiatrists, psychologists, counselors, and social workers is the most commonly recommended intervention (Abram, 1968, 1969; Crammond, Knight,

& Lawrence, 1967; Daly, 1970; Fried, Danks, & Beavert, 1976; Halper, 1971; Kaye, Leigh, & Straugh, 1973; Lefebvre, Norbert, & Crombez, 1972; Marshall, 1974; Newmann, 1983; Schlebusch & Levin, 1982). There have been no controlled studies reported in the literature where psychotherapy or counseling has improved compliance to the hemodialysis treatment regimen. This remains an area for future research.

Behavioral methods for altering hemodialysis patients' compliance have been utilized. In a study of 116 hemodialysis patients, Cummings, Becker, Kirscht, and Levin (1981) divided the patients into three groups: behavioral contract with patient, behavioral contract with relative or friend to aid patient in the achievement of compliance, and regular telephone contact control group. It was found that after 6 weeks of treatment there was a significant drop in serum potassium and interdialysis weight gain for the two behavioral groups, but that after a 3 month period without the behavioral contract in effect there was a return to precontract compliance levels. Tucker, Ziller, Rorer, and Smith (1984), using education about diet, self-monitoring of fluid consumption, teaching the relationship between fluid intake and interdialysis weight gain, and praise from nurses for compliance, found significant improvement among the worst fluid abusers but not for the group of hemodialysis patients as a whole.

Self-Efficacy: A Theoretical Framework for the Study of Health Related Behaviors

Bandura (1977a, 1977b, 1982, 1984) has postulated and offered evidence in support of Self-Efficacy Theory in explaining behavior change. Following a brief description of the theory and evidence supporting it, a discussion of self-efficacy and health related behaviors will be undertaken.

Self-Efficacy Theory is based on the principal assumption that psychological procedures, irrespective of their form, serve as a means of creating and strengthening expectations of personal efficacy (Bandura, 1977a). Personal efficacy is a construct composed of two components--outcome expectancy and efficacy expectancy. An outcome expectancy is defined as a person's estimate that a given behavior will lead to certain outcomes, whereas an efficacy expectancy is the conviction that one can successfully execute the behavior required to produce the outcomes. Efficacy expectations are conceptualized as a mediating variable between individuals and their behavior while outcome expectations are seen as an intermediary between individuals' behaviors and their outcomes.

The distinction between outcome and efficacy expectations is necessary because individuals can believe that a particular behavior can lead to a desired outcome, but if individuals are not confident that they can successfully implement the behavior, no behavior change is likely to occur. It must be emphasized that outcome and efficacy expectations reflect individuals' beliefs about their capabilities and about behavior-outcome linkages (Strecher, DeVellis, Becker, & Rosenstock, 1986). Behavior is therefore influenced by individuals' perceptions of, not the reality of, their behavior and its relationship to the environment. Also, self-efficacy is a situation specific construct. Unlike locus of control (Rotter, 1966), which refers to individuals' generalized response tendencies, the concept of self-efficacy refers to individuals' beliefs about their capabilities of performing specific behaviors in specific situations (Bandura, 1982; O'Leary, 1984).

Bandura (1977a) maintains that self-efficacy influences all aspects of behavior including the acquisition of new behaviors and the inhibition or

disinhibition of existing behaviors. It affects individuals' choices of behavioral settings, the amount of effort expended to accomplish tasks, and the persistence of behaviors in the face of obstacles.

Individuals' expectations of self-efficacy are influenced by four major sources of information: performance accomplishments, vicarious experience, verbal persuasion, and physiological states (Bandura, 1977a). Performance accomplishments refer to learning that occurs through personal experience in which one achieves mastery over a behavioral task. Through mastery self-efficacy increases. Feedback about the relationship between behavior and outcome, as well as reinforcement of behavior, can also communicate this type of information and therefore increase self-efficacy (Strecher et al., 1985). Vicarious experience is essentially observational learning where individuals are influenced by watching models' performances of behavioral tasks. Verbal persuasion involves the altering of individuals' expectations by exposure to information and exhortations from another person concerning the performance of particular tasks. Physiological states provide feedback to individuals that they believe to be predictive of success or failure in a particular behavioral situation. Sweaty palms, for example, are frequently associated with anxiety which often impedes performance.

Self-efficacy focuses almost exclusively on the effects produced by individuals' own behavior and is conceptualized as arising from diverse sources of information (as previously noted) conveyed by direct and mediated experience (Bandura, 1977a). These factors have significant implications for the measurement of self-efficacy. Expectations of personal efficacy do not operate as dispositional determinants of behavior independent of the context in which the behavior is occurring (Bandura, 1984). Unlike many explanations

of motivation and behavior, self-efficacy is situational and behavior specific. It is meaningless to talk about an individual's self-efficacy without reference to a particular behavior performed in a specific context. For example, an individual may have high personal efficacy with respect to driving a car on an open highway, but may have much lower efficacy expectations for driving a car in rush hour traffic on the freeway. Or, an individual may feel quite confident about public speaking, but less efficacious with respect to compliance to a prescribed medical regimen. With this in mind, Self-Efficacy Theory requires a microanalysis of perceived coping capabilities in specific situations rather than the assessment of global response tendencies or personality traits (Bandura, 1982).

Bandura (1977a) states, "An adequate expectancy analysis, therefore, requires detailed assessment of the magnitude, generality, and strength of efficacy expectations commensurate with the precision with which behavioral processes are measured" (p. 194). Magnitude refers to the arrangement of tasks in order of difficulty on a hierarchy. Some of the tasks are easily accomplished by an individual, others are more difficult. Generality refers to how circumscribed efficacy expectations are for similar and dissimilar tasks. When an individual has more generalized efficacy expectations toward a class of tasks, that individual feels confident of success for tasks which are more dissimilar to the task or tasks originally mastered. Strength of self-efficacy refers to an individual's persistence in attempting the task despite meeting obstacles.

Most studies attempt to operationalize the measurement of self-efficacy in a manner closely modeled after the method used by Bandura (1977a). Typically, individuals are presented with a hierarchical list of performance

activities in order of increasing difficulty and asked if they could currently perform each. Another strategy used to measure magnitude of efficacy expectations is to ask the subject to rate the perceived difficulty of performing a particular task in a specific situation on a Likert scale. Subjects are then asked to indicate for each item, how confident they are about their magnitude estimate. This confidence of efficacy expectation is indicated on a 100 point scale divided into 10-point intervals where 10 indicates little confidence and 100 indicates complete confidence. Generality is usually assessed by asking the subject to perform tasks of increasing dissimilarity from the mastered task and observing at what point the subject fails to be successful.

Although the study of self-efficacy is relatively new, a significant body of research has accumulated in support of it. Most of the research closely follows the microanalytic framework advocated by Bandura (1977a, 1982). His classic study (Bandura, 1977a) will now be used to illustrate the typical experiment performed and the results obtained.

To test Self-Efficacy Theory, an experiment was conducted wherein individuals with severe phobias received treatments designed to create differential levels of efficacy expectations, and then a microanalysis of the relationship between self-efficacy and behavioral change was undertaken. Adult snake phobics were administered either participant modeling, modeling alone, or no treatment for equivalent periods of time. The participant modeling condition included aiding the subjects by whatever means necessary to engage in increasingly threatening interactions with a boa constrictor. Therapeutic tasks included the subjects moving increasingly close to the snake, holding the snake in their hands at arms' length, holding the snake in front of their faces and allowing the snake to crawl freely in their laps. Subjects

who received the modeling treatment did not engage in the therapeutic tasks themselves but observed the therapist perform the tasks outlined previously. Subjects in the control condition completed the self-efficacy measures but did not receive any training or exposure to the snake.

Beginning with the pretreatment, efficacy expectations were assessed throughout the training. Subjects were asked to indicate which of 18 tasks, ranked in increasing difficulty, they could accomplish currently. Strength of efficacy expectations for all tasks were rated on a 100 point scale in 10-point intervals from great uncertainty to great certainty. Generality was assessed by asking patients to rate efficacy expectations for snakes similar and dissimilar to the snake used in treatment. Measures were obtained prior to treatment, following treatment but before behavioral posttest, and after completing behavioral posttest.

The results were consistent with Self-Efficacy Theory predictions with participant modeling producing higher, more generalized, and stronger efficacy expectations than did vicarious modeling, which, in turn, produced greater changes in self-efficacy than did the control condition. Performance in behavioral posttests closely reflected changes in magnitude, strength, and generality of self-efficacy change. Although the treatments varied in their effectiveness to alter efficacy expectations, the efficacy expectations were equally predictive of subsequent performance, irrespective of the treatment used to produce the change. Within treatments, subjects with higher self-efficacy consistently performed more difficult tasks.

Similar findings for a wide range of investigations have been reported including anxiety disorders (Bandura, Adams, Hardy, & Howells, 1980; Bandura, Reese, & Adams, 1982; Biran & Wilson, 1981), depression (Davies &

Yates, 1982; Kanfer & Zeiss, 1983), motivation (Bandura & Cervone, 1983), achievement behavior (Bandura & Schunk, 1981; Schunk, 1984), career choice and career development (Betz & Hackett, 1981; Hackett & Betz, 1981), and athletic attainments (Barling & Abel, 1983; Weinberg, Gould, Yukelson, & Jackson, 1981). Since the methodology used and results obtained in these studies generally parallel those of Bandura (1977a), a detailed review will not be included. Instead, a detailed review of the literature which examines the relationship between self-efficacy and health related behaviors will be presented.

Self-Efficacy and Health Related Behaviors

As Self-Efficacy Theory has become more widely known and as evidence supporting it has accumulated, interest within the field of behavioral medicine, broadly defined, has increased. Although a general biopsychosocial perspective (Engel, 1977) has widespread acceptance within behavioral medicine, no current theory has provided a model adequate for the explanation and prediction of the wide range of phenomena encompassed by the field (Strecher et al., 1986). Self-Efficacy Theory has been offered as a theory that can potentially serve as a unifying model for the behavioral medicine field (O'Leary, 1985). Applications of Self-Efficacy Theory have been made to diverse health related behaviors including cigarette smoking and relapse, pain experience and management, eating disorders, and exercise in chronically ill populations.

Cigarette smoking and self-efficacy

Cigarette smoking has been extensively studied from a self-efficacy framework. A large number of investigations have been reported in the literature (Colletti, Supnick, & Payne, 1985; Condiotte & Lichtenstein, 1981;

DiClemente, 1981; DiClemente, Prochaska, & Gilbertini, 1985; Glasgow, & Kleges, 1985; Killen, Godding Maccoby, & Taylor, 1984; McIntyre, Lichtenstein, & Mermelstein, 1983; McIntyre, Mermelstein, & Lichtenstein, 1980; Prochaska, Crimi, Lapsanski, Martel, & Reid, 1982; Reynolds, Creer, Holroyd, & Tobin, 1982; Walker & Franzini, 1983). Subjects in the previously cited studies have typically completed self-efficacy measures prior to and after completing behaviorally based stop smoking programs. Posttreatment self-efficacy is then used to predict smoking cessation outcome at follow-up. For example, McIntyre et al. (1980) found that posttreatment self-efficacy scores were significantly associated with smoking status at follow-up 3 months after treatment (r=-0.50) and at 6 month follow-up (r=-0.36), but not at 1 year follow-up (r=-0.15).

Colletti et al. (1985), in a similar investigation, found a significant correlation between posttreatment self-efficacy scores and smoking rate at follow-up 3 months and 6 months later. Seventy-nine percent of their subjects, who had evidenced meaningful changes in self-efficacy between posttreatment and 1 month follow-up assessments, had smoking rates consistent with what would be predicted by Self-Efficacy Theory. That is, individuals with higher self-efficacy scores were characterized by lower smoking rates. DiClemente (1981) found that subjects who had stopped smoking and were abstinent 5 months later had signficantly higher self-efficacy scores than those who had relapsed by 5 months posttreatment. He also reported that subjects with higher self-efficacy ratings had proportionally longer periods of smoking abstinence and experienced less difficulty maintaining abstinence. Other similar studies have yielded research findings

consistent with Self-Efficacy Theory (Condiotte & Lichtenstein, 1981; DiClemente et al., 1985; Godding et al., 1985).

Pain management and self-efficacy

Several studies have been undertaken that have investigated the relationship of self-efficacy and pain (Chaves & Barber, 1974; Craig, 1984; Fordyce, Fowler, Lehmann, DeLateur, Sand, & Treischmann, 1973; Turk, Meichenbaum, & Genest, 1983). Neufield & Thomas (1977) investigated the effect of false efficacy feedback on subjects who were taught relaxation coping skills to alleviate cold-pressor pain produced by hand immersion in ice water. Subjects performed trials by immersing hands in cold whater while relaxing and being given feedback that either they were relaxing well or failing to relax adequately. In subsequent trials, subjects who were previously told that they were adequately relaxing tolerated pain significantly longer than those who were told that they had not adequately relaxed. The authors state that this was the case despite the fact the two groups did not differ significantly in their actual relaxation. They concluded that perceived self-efficacy, independent of actual performance, affects an individual's ability to cope with pain. Unfortunately, the authors did not directly assess change in levels of self-efficacy in their subjects.

In a study by Reese (1982), subjects were assigned to three psychological treatments to help them cope with cold-pressor induced pain. Patients were randomly assigned to groups which learned either cognitive techniques or relaxation techniques, received an analgesic placebo or no treatment (control). Self-efficacy was assessed at posttreatment but prior to the administration of the cold-pressor test. While the cognitive group was significantly superior to the relaxation group in pain tolerance and the

relaxation group was superior to both the placebo and control groups, the results indicated that correlations between posttreatment self-efficacy to manage pain and cold-pressor test performance were high regardless of the means used to manage pain. Strength of perceived efficacy to tolerate pain and self-efficacy in reducing pain were both significantly related to pain threshold and pain tolerance.

Other studies have demonstrated similar relationships between self-efficacy and clinical pain which, unlike laboratory induced pain, tends to be characterized by higher pain levels and lack of patient control over the pain (Holroyd, Penzien, Hursey, Tobin, Rogers, Holm, Marcille, Hall, & Chila, 1984; Klepac, Dowling, & Hauge, l982; Manning & Wright, 1983; Shoor & Holman, 1985).

Weight control and self-efficacy

Weight control involves behaviors similar to those necessary for compliance to the hemodialysis regimen. In both situations patients strive to adhere to a prescribed regimen. It is therefore especially interesting that the literature indicates that there is a relationship between self-efficacy and weight reduction.

Chambliss and Murray (1979) gave a placebo medication to the 68 female volunteers in their weight loss program, telling them that the drug would help them lose weight by increasing their metabolic rate. After two weeks of treatment, half of the group was told that the drug was inert and that the subjects were actually responsible for their weight loss not the drug. This attempt to manipulate self-efficacy was effective only in subjects with an internal locus of control who continued to lose weight, whereas those individuals with external loci of control continued to attribute their weight loss

to environmental or social factors. At follow-up the internal locus of control group had lost more weight than either the external locus of control group or the group who continued to attribute their weight loss to the placebo medication. Unfortunately, self-efficacy was not assessed directly in this study, so it is not certain that this variable was altered by the experimental conditions.

Weinberg, Hughes, Critelli, England, & Jackson (1984) conducted a similar study, though, in which self-efficacy was assessed. Subjects with a high level of self-efficacy initially lost more weight than individuals with low initial self-efficacy. Within each group, subjects given high efficacy feedback (i.e. they were responsible for their weight loss) lost more weight than those given low efficacy feedback (diet medication was responsible for weight loss).

Exercise in chronically ill patients and self-efficacy

Exercise is an important component in rehabilitation programs utilized by chronically ill patients including those on hemodialysis. The relationship between self-efficacy and compliance to exercise regimens has been investigated in two groups of medical patients--post-myocardial infarction patients and chronic obstructive pulmonary disease patients.

Ewart, Taylor, Reese, & DeBusk (1984) found that in the 40 male post-myocardial infarction patients included in their sample, treadmill performance predicted increases in self-efficacy which, in turn, predicted self-reported duration of exercise and peak heart rate during home exercise. In another closely related study, Taylor, Bandura, Ewart, Miller, & DeBusk (1985) studied the effect of post-myocardial infarction patients' treadmill performance on their wives efficacy expectations of their husband's treadmill performance. Wives of patients were randomly assigned to one of three conditions:

uninvolved, waiting in another room during their husband's treadmill exercise session; watching their husband's treadmill exercise session; and taking the treadmill test herself. At pretest husbands' self-efficacy expectancies were moderate, whereas wives' self-efficacies toward husbands' performances on the treadmill tended to be low. Only in the wives who took the treadmill test themselves did the wives' self-efficacy concerning their husband's performance on the treadmill increase significantly. In this group correlations between end of session efficacy judgments and cardiovascular capacity at 3 and 6 month follow-ups were high, whether judgements were made by husband or wife.

In another study using patients with chronic obstructive pulmonary disease, Kaplan, Atkins, & Reinsch (1984) randomly assigned subjects to one of three treatments designed to increase walking. Groups utilized either behavioral, cognitive, or combined cognitive-behavioral training strategies. Behavioral groups incorporated goal setting, behavioral contract, and contingency management, whereas the cognitive group challenged irrational beliefs concerning the effects of walking. Self-efficacy for walking was increased the most for the combined cognitive-behavioral group with significantly less increase for the behavioral and cognitive groups which evidenced approximately equal increases in self-efficacy. At 3-month follow-up walking self-efficacy was significantly correlated (r=0.32) with compliance to the walking program which the patients were prescribed by their physicians.

Summary

Considerable supporting evidence exists that levels of self-efficacy are significantly associated with a wide range of health related behaviors. Research has consistently shown that individuals who have high

self-efficacy, whether preexisting or modified by training, are more likely to stop smoking for longer periods of time, to tolerate pain better, and to be more adherent to exercise and diet regimens.

Implications of Self-Efficacy Research for Compliance to Hemodialysis Treatment Regimens

Although research linking self-efficacy and compliance is relatively scant and recent, a clear picture is emerging--changes in self-efficacy are consistently related to changes in compliance. Strecher et al. (1986) write, ". . . In experimental studies, manipulations of self-efficacy have proven consistently powerful in initiating and maintaining change" (p. 87). Clinicians and researchers alike have been struck by the low compliance rates exhibited by hemodialysis patients as well as the lack of a generally acceptable model of compliance within the field. It is possible that lack of progress in each of these are mutually related.

Self-Efficacy Theory may provide a useful tool in understanding patients' compliance to the hemodialysis regimen. As understanding of compliance within this setting and population improves, better interventions can be developed to assist patients in improving their compliance. This study is an initial step toward this goal and involves

1. development of an instrument to assess the self-efficacy of hemodialysis patients.
2. assessment of the relationship of self-efficacy and compliance to various aspects of the hemodialysis regimen.

CHAPTER III
METHODOLOGY

The purposes of this study are the following:

1. To develop an assessment instrument to measure hemodialysis patients' self-efficacy with respect to fluid intake.
2. To investigate the relationship of compliance and self-efficacy of hemodialysis patients.
3. To investigate the effectiveness of two behaviorally based interventions for improving hemodialysis patients' self-efficacy with respect to and compliance to fluid restrictions necessary for safe and effective treatment.

The study was conducted in two phases. In Phase 1 a Patient Self-Efficacy Questionnaire (PSQ) was developed to measure hemodialysis patients' self-efficacy with respect to adherence to fluid restrictions. In Phase 2 the effectiveness of two behaviorally based interventions to alter patient self-efficacy and compliance to fluid restrictions was investigated. The PSQ developed in Phase I was used to measure changes in self-efficacy.

Research Hypotheses

1. There is agreement between patient self-efficacy measured at the first administration of the Patient Self-Efficacy Questionnaire (PSQ) and self-efficacy measured one week and one month later using the same instrument.

2. There is are statistically significant relationships between self-efficacy at the start of Phase 1 and fluid, dietary, and medication adherence as measured by average interdialysis weight gain, BUN level, Bicarbonate level, serum potassium, and serum phosphorous levels, respectively.
3. There are statistically significant relationships between patient demographic variables and self-efficacy.
4. There are statistically significant relationships between patient demographic variables and compliance to fluid restrictions.
5. There are statistically significant differences between compliance to fluid restrictions during baseline, treatment, and follow-up for patients in the two treatment groups and the control group.
6. There are statistically significant relationships between fluid compliance and self-efficacy at baseline, treatment, and follow-up for patients in the two treatment groups and the control group.

Subjects and Participants

Phase 1

All individuals at the Adult Dialysis Unit of Shands Hospital, Gainesville, Florida, who met the following criteria were asked to complete the Patient Self-Efficacy Questionnaire (PSQ) (see Appendix A).

1. The patient has a primary diagnosis of End Stage Renal Disease requiring hemodialysis at least two times per week.
2. The patient has undergone hemodialysis regularly for at least six months prior to Phase 2 of the study.

3. The patient gives written informed consent to participate in Phase 1 of the study (see Appendix B).

Of the 34 patients being dialyzed at the start of the project, 32 were asked to participate. The 2 patients who were not invited to participate in the project were developmentally disabled and unable to complete the PSQ. Twenty-nine patients started Phase 1 of the project as 2 refused to participate and 1 patient was transferred to Continuous Ambulatory Peritoneal Dialysis (CAPD). Twenty-five patients completed Phase 1 of the project as 1 patient died, 2 were transferred to CAPD, and 1 patient officially withdrew. Table 3.1 summarizes the characteristics of patients participating in Phase 1 of the study.

Phase 2

Nineteen patients from among the patients in Phase 1 who met the following additional criteria served as subjects in Phase 2 of this study:

1. The patient had an average daily fluid weight gain of two pounds or more per day for Phase 1 of the study. This criterion was established by Dr. Donald Mars, Medical Director of the Shands Adult Dialysis Unit. Patients are routinely advised that they are not to gain in excess of two pounds per day. Patients gaining more than two pounds per day are considered non-compliant for clinical purposes and also for the purposes of this study.
2. The patient gave written informed consent to participate in the study (see Appendix C).
3. The patient was certified medically stable by the dialysis unit physician.

Table 3.1

Phase 1 Patient Characteristics (n=29)

Age	52.3 ± 14.8
Education	10.0 ± 3.5
Sex	
males	10 (35%)
females	19 (65%)
Race	
white	7 (24%)
black	22 (76%)
Marital Status	
single	5 (17%)
married	12 (41%)
divorced	6 (21%)
widowed	6 (21%)
Support	
Yes	26 (93%)
No	2 (7%)
Air Conditioning	
Yes	18 (64%)
No	10 (36%)
Transplant List	
Yes	11 (42%)
No	15 (58%)

Table 3.2

Phase 2 Patient Characteristics (n=18)

	Group 1[a]	2[b]	3[c]
Age	57.5 ± 13.2	50.7 ± 17.9	48.2 ± 13.6
Education	7.2 ± 3.6	10.7 ± 2.7	12.0 ± 4.2
Sex			
Male	0 (0%)	3 (43%)	2 (40%)
Female	6 (100%)	4 (57%)	3 (60%)
Race			
White	2 (33%)	2 (29%)	1 (20%)
Black	4 (67%)	5 (71%)	4 (80%)
Marital Status			
Single	0 (0%)	2 (29%)	1 (20%)
Married	2 (33%)	1 (14%)	2 (40%)
Divorced	1 (17%)	2 (29%)	1 (20%)
Widowed	3 (50%)	2 (29%)	1 (20%)
Social Support			
Yes	6 (100%)	6 (100%)	5 (100%)
No	0 (0%)	0 (0%)	0 (0%)
Air Conditioning			
Yes	3 (50%)	0 (0%)	2 (40%)
No	3 (50%)	7 (100%)	3 (60%)
Transplant List			
Yes	4 (67%)	3 (43%)	2 (50%)
No	2 (33%)	4 (57%)	2 (50%)

[a]n=6
[b]n=7
[c]n=5

Table 3.2 presents the characteristics of patients participating in Phase 2 of the study.

All 6 nurses and 3 technicians at the unit were asked to participate and agreed. The characteristics of nurses and technicians participating in the study are presented in Table 3.3. Participation involved attending two 2-hour training sessions during working hours as well as implementing the project protocol.

Table 3.3

Shands Adult Dialysis Unit Staff Characteristics

Nurses		Mean	Range
Age		34.7	30-39
Years in Nursing		8.7	1.5-18
Years in Hemodialysis Nursing		4.6	.33-11
Years at Shands ADU		2.3	.8-7.2
Sex			
Female	6(86%)		
Male	1(14%)		
Race			
Black	1(14%)		
White	6(86%)		
Degrees/Credentials			
MSN	1		
BSN	2		
Assoc. Degree in Nursing	1		
RN	3		

Table 3.3--continued

Technicians		Mean	Range
Age		28.3	22-37
Years in Nursing		4.5	2-9.0
Years as Hemodialysis Technician		4.5	2.0-9.0
Years at Shands ADU		3.7	.9-7
Sex			
Female	1 (33%)		
Male	2 (67%)		
Race			
Black	3 (100)		
White	0 (0%)		

Instrumentation

Two instruments were utilized in this study. They were

1. Patient Self-Efficacy Questionnaire (PSQ).
2. Patient Demographic Form (PDF) (see Appendix D).

Patient Self-Efficacy Questionnaire (PSQ). Self-efficacy, as previously noted, is a situation and behavior specific construct, and therefore, an assessment instrument must be tailored for each intended application. Since no instrument has yet been developed to assess hemodialysis patients' self-efficacy with respect to their compliance to fluid restrictions, development of such an instrument constituted Phase 1 of this study.

The PSQ consists of 9 items. Items 1 through 6 are designed to assess efficacy expectations, whereas items 7 through 9 are designed to assess outcome expectations. Prior to the start of Phase 1 of this study, 9 patients at two nonparticipating dialysis units were asked to rank order the difficulty they experienced in controlling fluid intake in the situations included in PSQ items 1-6. Based on this informal polling of dialysis patients, items were tentatively arranged in order of increasing difficulty. For each item patients participating in this study were asked to indicate the (1) magnitude of efficacy or outcome expectations, and (2) strength (confidence) of efficacy or outcome expectations. The patient indicates the magnitude of efficacy and outcome expectations by checking those items which the patient can currently perform. Strength (confidence) of efficacy and outcome expectations for each PSQ item are indicated on l0-point scales which are labeled from l0% to l00% confidence.

Patient Demographic Form (PDF). Prior to the start of Phase 1, the researcher obtained the following information from the patient's medical record and entered it on the PDF: age, gender, race/ethnicity (white, black), number of months on hemodialysis, number of years of education, marital status (single, married, divorced, widowed), presence of a support person in the patient's life, presence of airconditioning in patient's domicile, and patient's transplant status.

Procedures

Training of Nurses

Nurses were trained separately for Phases 1 and 2 of the study at two 2-hour sessions conducted by this researcher prior to the start of each phase of the study. The training for Phase 1 consisted of the following:

1. A presentation of an overview and description of the study.
2. Familiarization with a sample script that nurses will follow to invite patients to participate in the study (see Appendix E).
3. Familiarization with the PSQ and the procedures for administering it to patients.

Training for Phase 2 of the study consisted of a description of and practice in executing Treatments 1 and 2 (see Appendices F, G, H, and I).

A video tape demonstrating project treatment procedures was viewed by each staff member during Phase 2 training. Staff member's competency to execute patient training was assessed by the individual accurately describing and demonstrating study procedures to this researcher. In addition, during each phase of the project each participating staff member was observed at least once implementing the project procedures by the researcher. If a staff member incorrectly administered the observed treatment procedure, appropriate remediation was given.

Phase 1

Each patient who met Phase 1 criteria was asked to participate by either a nurse from the dialysis unit or by this researcher. The patient was told about the nature of Phase 1 of the study, its purposes and potential benefits (see Appendix E). Each patient was then asked to sign an informed consent form agreeing to participate in the research.

Each participating patient was asked to complete the PSQ three times--at the start of the study, one week, and one month later. Patient names were not recorded on the PSQ's to protect patient privacy. Instead code numbers were used to identify each patient's PSQ. Only the researcher and the dialysis unit head nurse or her designatee had access to a master code list

which was kept locked in a secure location. Each patient was read the PSQ by a nurse, technician, or the researcher while receiving dialysis treatment. If the patient asked for clarification concerning any PSQ item, nurses had been instructed to provide standard explanations of the PSQ items which were provided to them during training to ensure that patients receive accurate and uniform clarifications of PSQ items.

Concurrently, objective compliance data which were normally collected as part of routine patient care were obtained from medical records by the researcher. These data included interdialysis weight gains, BUN level, bicarbonate level, serum phosphorous and serum potassium levels. Also, the researcher obtained patient demographic data and recorded them on each patient's PDF.

Phase 2

From the data collected in Phase 1 of the study, l9 patients were selected who had average daily fluid weight gains of greater than or equal to 2.0 pounds. This criterion was chosen because it is the maximum fluid intake recommended to patients by the dialysis unit medical director and staff. These non-compliant patients were asked to participate in Phase 2 of the study if they were medically stable. Since this determination is most appropriately made by a physician, the medical director of the dialysis unit was responsible for certifying the medical stability of each patient participating in Phase 2 of the study. The purpose, description, risks, and benefits of participation in Phase 2 of the study were verbally presented to the patients identified as non-compliant according to the criterion described previously (see Appendix F). Either a unit nurse or the researcher performed this function. A separate written informed consent was obtained for patients participating in Phase 2 of the study.

Patients were randomly assigned to each of the following groups:

1. Self-monitoring and self-recording of fluid intake by patient.
2. A behavioral treatment package including
   a. self-monitoring and self-recording of fluid intake by patient,
   b. graphic feedback by nurses of the relationship between each patient's fluid intake and interdialysis weight gain,
   c. systematic, structured verbal reinforcement by nurses of decreases in patients' interdialysis weight gains.
3. No treatment control group who received routine health care.

Seven patients were randomly assigned to each treatment group (Group 1 and 2). Five patients were randomly assigned to the no-treatment control group. One Group 1 patient officially dropped out of the study, leaving 6 patients in that group. One patient from Group 2 dropped out of the study and 1 was transferred to CAPD, leaving 5 patients in Group 2. One patient in Group 3 died while another was transferred to CAPD, leaving 3 patients in that group. Each intervention was implemented for a period of 8 weeks during which all other aspects of routine patient care were continued. Patients in each group did not begin the study simultaneously. Rather, to control against the effects of extraneous factors, 2 or 3 patients in each group were started on successive treatment days until all had begun the study. A 4-week period during which behavioral treatment interventions were discontinued followed the 8 weeks of treatment. Compliance data were collected during the 8-week treatment and 4-week no-treatment follow-up. The PSQ was readministered after 4 weeks of treatment and at the end of treatment and follow-up. After follow-up all patients were offered the opportunity to learn the most effective intervention.

Procedures for Treatment 1

Each patient was given a copy of the self-monitoring and self-recording instructions (see Appendix G), a fluid measuring bottle, and a supply of fluid record sheets. A nurse or the researcher trained the patient in the self-monitoring and self-recording procedures, answered any questions, and asked the patient to demonstrate proper use of the fluid measuring bottle and fluid record sheets in order to verify patient understanding of the procedure. Training continued until the patient could correctly demonstrate the procedure unaided by the trainer. Patients were asked to turn in fluid record sheets each time they came in for treatment. The nurse who collected the fluid record sheets verbally praised the patients for bringing in the fluid record sheets. Nurses were told to continue their routine responses to patients concerning their fluid weight gains, making sure that they did not systematically use structured praise as was done in Treatment 2. This was done to ensure that treatment integrity was not violated. After an 8-week intervention period patients were told to discontinue self-monitoring and self-recording activities. After the 4-week follow-up period was over, the patient was instructed in the most effective intervention if desired.

Procedures for Treatment 2

Each patient in Treatment 2 received the training in self-monitoring and self-recording and followed the procedures outlined in Treatment 1. In addition, each time the patient was dialyzed, the nurse caring for that patient plotted average daily fluid intake and weight gain since the patient's last dialysis treatment on a graph following the procedure outlined in Appendix H. The nurse then showed the graph to the patient and drew the patient's attention to the fact that the fluid weight gain of the patient is directly related to

the amount of fluid which the patient drinks. If the patient's self-report of average daily fluid intake was significantly discrepant from his or her average daily fluid weight gain (i.e. the lines on the graph were not close together), then the patient was informed of the need for more careful self-monitoring. Patients were told that they could gain less weight between dialysis treatments by drinking less fluid. They were encouraged to carefully measure and record fluid intake.

Nurses also gave systematic, structured verbal reinforcement, in the form of praise, for decreases in average daily fluid weight gain as outlined in Appendix I.

Research Design

Phase 1 of this study utilized a correlational research design. The research design used in Phase 2 of the study was a multiple baselines across subjects design. This design minimizes threats to internal and external validity while allowing the use of a small sample size (Kratchowill, 1978). Single subject research designs have several advantages including (Wilson & O'Leary, 1980)

1. Treatment of individual clients can be objectively evaluated.
2. Situations where few subjects are available can be studied, whereas traditional between subject research designs and data analysis procedures would require larger sample sizes.
3. Effective treatment packages can be assembled by sequentially adding treatment components.
4. A relatively large number of treatments can be evaluated with relatively few subjects.

Significant disadvantages are also associated with single subject designs (Wilson & O'Leary, 1980). These include

1. The generality of findings may be limited.
2. Interpretation of results may be difficult if the results of the interventions are different across subjects within treatment groups.
3. If significant variability is present in the target behavior, clear cut interpretations of data may be difficult.
4. Visual interpretation may differ from interpretations based on statistical techniques.

The present study, while acknowledging the advantages and disadvantages of the single subject research methodology, has been designed to minimize the disadvantages while exploiting the advantages. In this particular application the researcher believes that the advantages of single subject research designs outweigh the potential limitations.

Data Analysis

All correlation coefficients generated in the data analyses of Hypotheses 1, 2, 3, 4, and 6 were computed utilizing Pearson product-moment techniques. The relationship of patient characteristics, which were categorical variables, to self-efficacy and compliance in Hypotheses 3 and 4, respectively, were determined by Analyses of Variance (ANOVA) and Chi-Square tests, respectively. Because multiple comparisons were conducted in each case, adjustments of significance criteria according to Bonferroni's method were performed. A 3X3 Repeated Measures ANOVA was used to test for differences in fluid weight gains among the treatment groups across time in

Hypothesis 5. A 2X3 Repeated Measures ANOVA was used to test for treatment versus nontreatment differences in fluid weight gains across time in Hypothesis 5. Also, visual inspection of graphs of average daily fluid weight gain by dialysis treatment was conducted.

CHAPTER IV
RESULTS

The first research hypothesis states that there is agreement between patient self-efficacy measured at the first administration of the Patient Self-Efficacy Questionnaire (PSQ) and self-efficacy measured one week and one month later using the same instrument. Table 4.1 presents test-retest reliability coefficients for all patients' magnitude of self-efficacy estimates for PSQ items, efficacy and outcome expectations, and total self-efficacy over one-week and one-month intervals. These Pearson product-moment correlation coefficients ranged from a low of $\underline{r}$ = .42 for Item 9 to a high of $\underline{r}$ = .83 for Item 7 for the one-week interval and from a low of $\underline{r}$ = .50 for Item 1 to a high of $\underline{r}$ = .80 for Item 4 for the one-month interval. All correlation coefficients were greater than $\underline{r}$ = .50 except for the one-week test-retest correlation coefficient for Item 9 which was $\underline{r}$ = .42

The magnitude dimension of efficacy expectations had one-week and one-month test-retest correlation coefficients of $\underline{r}$ = .80 and $\underline{r}$ = .76, respectively. One-week and one-month test-retest correlation coefficients for the magnitude dimension of outcome expectations were $\underline{r}$ = .67 and $\underline{r}$ = .64, respectively. Test-retest correlation coefficients over one-week and one-months intervals, respectively, were $\underline{r}$ = .80 and $\underline{r}$ = .70 for magnitude ratings of total self-efficacy.

Table 4.1

Test-Retest Correlation Coefficients for Magnitude of Self-Efficacy Estimates (n=29)

	1 week		1 month	
Items	r	p	r	p
1	.51	.0001	.50	.0001
2	.68	.0001	.51	.009
3	.54	.003	.60	.001
4	.78	.0001	.80	.0001
5	.79	.0001	.68	.0002
6	.73	.0001	.60	.002
7	.83	.0001	.58	.001
8	.61	.0005	.78	.0001
9	.42	.02	.51	.008
Efficacy Expectations	.80	.0001	.76	.0001
Outcome Expectations	.67	.0001	.64	.0002
Total Self-Efficacy	.80	.0001	.70	.0001

Table 4.2 presents test-retest reliability coefficients for the confidence of patients' self-efficacy estimates for PSQ items, efficacy and outcome expectations, and total self-efficacy over one-week and one-month intervals. These Pearson product-moment correlation coefficients ranged from a low of $r = .40$ for Item 9 to a high of $r = .86$ for Item 4 over the one-week interval and from a

low of r = .37 for Item 1 to a high of r = .78 for Item 8 over the one-month interval.

Table 4.2

Test-Retest Correlation Coefficients for Confidence in Self-Efficacy Estimates (n=29)

	1 week		1 month	
Items	r	p	r	p
1	.57	.0007	.37	.07
2	.57	.0008	.54	.005
3	.54	.003	.68	.0002
4	.86	.0001	.72	.0001
5	.78	.0001	.74	.0001
6	.71	.0001	.69	.0001
7	.71	.0001	.48	.01
8	.60	.0007	.78	.0001
9	.40	.04	.50	.01
Efficacy Expectations	.64	.0001	.65	.0005
Outcome Expectations	.68	.0001	.77	.0001
Total Self-Efficacy	.79	.0001	.79	.0001

All correlation coefficients for the one-week interval were greater than r = .50 except Item 9 which was r = .40 and for the one-month interval all correlation coefficients were greater than r = .48 except Item 1 which was

r = .37. The stability of patients' confidence in their magnitude of Efficacy Expectation Subscale ratings, as measured by one-week and one-month test-retest reliability coefficients, was r = .64 and r = .65, respectively. Stability of patients' confidence in their ratings of the magnitude of the Outcome Expectation Subscale over the same intervals were r = .68 and r = .77, respectively, for the shorter and longer intervals. Confidence in Total Efficacy was r = .79 for both intervals.

Table 4.3

Test-Retest Correlation Coefficients of Compliant (C) and Non-Compliance (NC) Patients

	Interval			
	1-Week		1-Month	
Magnitude	C[a]	NC[b]	C[a]	NC[b]
Efficacy Expectations	.49	.85	.26	.90
Outcome Expectations	.66	.69	.76	.86
Total Self-Efficacy	.56	.80	.45	.89
Confidence				
Efficacy Expectations	.47	.89	.17	.92
Outcome Expectations	.74	.67	.79	.85
Total Self-Efficacy	.57	.76	.42	.87

[a] n = 10

[b] n = 19

Compliant and non-compliant patients demonstrated a marked difference in the level of test-retest reliability over one-week and one-month intervals. For the purposes of this study patients were considered non-compliant when their average daily fluid weight gain was greater than two pounds. These data are presented in Table 4.3. Non-compliant patients' estimates of magnitude and confidence of their self-efficacy were more reliable than those of the compliant patients in the study. One-week and one-month stability coefficients for magnitude and confidence of efficacy expectations and total self-efficacy showed this phenomenon. The stability coefficients for magnitude and confidence of outcome expectations did not vary markedly between non-compliant and compliant groups of patients.

Overall, patients' ratings of magnitude and confidence of PSQ items, Efficacy and Outcome Expectations Subscales, and Total Self-Efficacy appear to be reliable. Thus, these data support Research Hypothesis 1 indicating that the PSQ is a reliable assessment instrument. Notable exceptions to this generalization are evident, though. The test-retest reliability of the PSQ may be inadequate when it is utilized with compliant patients. Also, the reliability of the patients' magnitude ratings on Item 9 over a 1-week test-retest interval, the confidence of patients' ratings of PSQ Item 9 over a 1-week interval and PSQ Item 1 over a 1-month interval have inadequate reliability coefficients.

Research Hypothesis 2 states that there are statistically significant relationships between self-efficacy measured at the start of Phase 1 of the study and fluid, dietary, and medication adherence during Phase 1, as measured by average daily fluid weight gain, BUN level, bicarbonate level, serum potassium, and serum phosphorous levels, respectively. Table 4.4 presents the Pearson product-moment correlation coefficients between

magnitude and confidence of patient self-efficacy estimates and measures of adherence. Magnitude of patients' efficacy expectations (r = -.33; p<.08) and total self-efficacy (r = -.39; p<.05) evidenced a significant inverse association with compliance as measured by average daily fluid weight gain. BUN level, a measure of dietary compliance, was inversely related to the magnitude of efficacy expectations (r = -.41; p<.05) and outcome expectations (r = -.35; p<.08) for control of fluid intake. Bicarbonate level, also a measure of dietary compliance, evidenced a positive significant relationship with efficacy expectations (r = .44; p<.05) and total self-efficacy (r = .47; p<.05). Thus, patients with higher self-efficacy measures were more compliant to fluid and dietary restrictions, as measured by average daily fluid weight gain and BUN level, respectively.

The confidence patients had in their self-efficacy ratings was significantly related to fluid compliance only for efficacy expectations (r = -.40; p<.05). Total self-efficacy was related to fluid compliance (r = -.24) but the correlation coefficient did not reach significance. Confidence in outcome expectations was inversely related to BUN level (r = -.39; p<.05) whereas confidence in total self-efficacy was related positively to bicarbonate level (r = .39; p<.05).

Data presented in Table 4.4 provide partial support for Research Hypothesis 2. Magnitude of self-efficacy ratings are generally related to average daily fluid weight gain, BUN, and bicarbonate levels but not to potassium (K) or phosphorous (P) levels. Confidence of self-efficacy ratings are generally unrelated to the compliance measures.

Table 4.4

Correlation Coefficients between Self-Efficacy and Compliance Measures (n=29)

	FWG	K	P	BUN	BICARB
Magnitude					
Efficacy Expectations	-.33**	.01	-.18	-.41*	.44*
Outcome Expectations	-.15	-.13	-.18	-.35**	.29
Total Self-Efficacy	-.39*	-.09	.19	-.32	.47*
Confidence					
Efficacy Expectations	-.40*	.09	-.02	-.16	.22
Outcome Expectations	-.04	-.12	-.20	-.39*	.30
Total Self-Efficacy	-.24	.23	-.16	-.11	.39*

*$p<.05$

**$p<.08$

Research Hypothesis 3 states that there are statistically significant relationships between selected patient characteristics and self-efficacy. Table 4.5 presents Pearson product-moment correlation coefficients between patient characteristics measured on continuous scales and self-efficacy. Significant relationships were found between age and magnitude of efficacy expectations ($r = .41$; $p<.05$) and total self-efficacy ($r = .42$; $p<.05$) with older patients having higher self-efficacy magnitude estimates. Education was also significantly related to all measures of magnitude of self-efficacy ($r = -.33$ to $r = -.57$) where

less educated patients rated their magnitude of self-efficacy higher. Time on dialysis was unrelated to magnitude of self-efficacy. Age was also related to patients' confidence in their estimates of outcome expectations (r = .32; p<.09) and total self-efficacy (r = .34; p<.09) with older patients indicating more confidence in their ratings of outcome and total self-efficacy. Education was inversely related to confidence in outcome expectations (r = -.57; p<.05); thus, less educated patients were more confident in their outcome expectations. Time on dialysis was unrelated to confidence of patients' self-efficacy.

Table 4.5

Correlation Coefficients between Patient Characteristics Measured on Continuous Scales and Self-Efficacy Measures (n=29)

	Age	Education	Time on Dialysis
Magnitude			
Efficacy Expectations	.41*	-.33**	-.06
Outcome Expectations	.29	-.57*	-.03
Total Self-Efficacy	.42*	-.37**	-.08
Confidence			
Efficacy Expectations	.17	.16	-.09
Outcome Expectations	.32**	-.57*	-.09
Total Self-Efficacy	.34**	-.19	-.20

*p<.05

**p<.09

Tables 4.6 through 4.11 present the results of separate analyses of variance between selected patient characteristics such as transplant status, sex, race, presence of support system, marital status, and presence of air conditioning in the home, which were categorical variables, and magnitude and confidence of estimates of efficacy expectations, outcome expectations, and total self-efficacy, respectively. Although the independent variable, sex, reached the $p<.05$ criterion for significance in the analysis of variance with confidence of outcome expectations as the dependent variable (Table 4.10), it likely represents a Type I error. When the Bonferroni method of correcting the probability level for multiple comparisons ($p<.05$ corrected to $p<.004$) is utilized, the difference in means observed no longer reached significance. No other results from the analyses of variance applied reached this criterion for significance, and thus, none of the categorical patient characteristics were found to be significantly related to any of the measures of self-efficacy.

Table 4.6

Relationship of Selected Patient Characteristics with Magnitude of Efficacy Expectations (n=29)

	df	F-Value	p-level
Transplant Status	1	1.87	.19
Sex	1	0.08	.78
Race	1	0.34	.57
Support System	1	0.03	.86
Marital Status	3	0.29	.83
Air-Conditioning	1	0.12	.74

Table 4.7

Relationship of Selected Patient Characteristics with Magnitude of Outcome Expectations (n=29)

	df	F-Value	p-level
Transplant Status	1	1.27	.28
Sex	1	3.71	.07
Race	1	0.00	.98
Support System	1	0.85	.37
Marital Status	3	0.65	.60
Air-Conditioning	1	0.19	.67

Table 4.8

Relationship of Selected Patient Characteristics with Magnitude of Total Self-Efficacy Score (n=29)

	df	F-Value	p-level
Transplant Status	1	0.35	.56
Sex	1	1.96	.18
Race	1	0.28	.60
Support System	1	0.15	.71
Marital Status	3	0.29	.83
Air-Conditioning	1	0.00	.96

Table 4.9

Relationship of Selected Patient Characteristics with Confidence of Efficacy Expectations (n=29)

	df	F-Value	p-level
Transplant Status	1	2.45	.14
Sex	1	0.04	.84
Race	1	0.77	.39
Support System	1	0.22	.90
Marital Status	3	0.20	.89
Air-Conditioning	1	0.10	.75

Table 4.10

Relationship of Selected Patient Characteristics with Confidence of Outcome Expectations (n=29)

	df	F-Value	p-level
Transplant Status	1	1.00	.33
Sex	1	5.95	.03
Race	1	0.03	.87
Support System	1	0.36	.56
Marital Status	3	1.30	.31
Air-Conditioning	1	0.06	.80

Table 4.11

Relationship of Selected Patient Characteristics with Confidence of Total Self-Efficacy Score (n=29)

	df	F-Value	p-level
Transplant Status	1	0.51	.49
Sex	1	0.72	.41
Race	1	0.35	.56
Support System	1	0.04	.85
Marital Status	3	1.10	.38
Air-Conditioning	1	0.05	.82

Thus, except for age and education, the data presented in Tables 4.5-4.11 indicate that patient characteristics are not related to self-efficacy measures and do not support Research Hypothesis 3.

Research Hypothesis 4 states that there are statistically significant relationships between patient characteristics and compliance to fluid restrictions during the pretreatment period. Table 4.12 presents the Pearson product-moment correlation coefficients between selected patient characteristics measured on interval scales and average daily fluid weight gains for all patients in the study during the pretreatment period. No statistically significant relationship was found between average daily fluid weight gain and the variables age, education, and time on dialysis.

Table 4.12

Relationship between Selected Patient Characteristics and Compliance to Fluid Restrictions (n=29)

	Correlation Coeff.	p-level
Age	-.22	.25
Education	-.12	.53
Time on Dialysis	-.11	.56

Table 4.13 presents the results of Chi-Square analyses of the patient categorical characteristics for compliance and non-compliance patients. Non-compliant patients were those with an average daily fluid weight gain

Table 4.13

Relationship of Selected Patient Characteristics (Categorical) and Compliance to Fluid Restrictions (n=29)

	df	Chi-Square	p-level
Transplant Status	1	1.418	.23
Sex	1	.206	.65
Race	1	.143	.71
Support System	1	3.877	.05
Marital Status	3	6.647	.08
Air-Conditioning	1	2.274	.13

greater than 2 pounds during the pretreatment period of the study. Although presence of a support system reaches the Chi-Square value for significance at the $p<.05$ level, when the Bonferroni method of correction for multiple comparisons is applied ($p<.05$ corrected to $p<.004$) the Chi-Square value no longer reaches the criterion for significance. Thus, none of the patient characteristics measured are significantly associated with compliance to fluid restrictions. These data do not provide support for Research Hypothesis 4.

Research Hypothesis 5 states that there are statistically significant differences between compliance to fluid restrictions during pretreatment, treatment, and posttreatment periods for patients in the two treatment groups and in the control group. Figure 4.1 presents graphs of the average daily fluid weight gains for each dialysis treatment during the pretreatment, treatment, and posttreatment periods for each patient in Treatment Group 1. Figures 4.2 and 4.3 present similar data for each patient in Treatment Group 2 and Group 3 (control), respectively.

Table 4.14 summarizes average daily weight gains for each patient in all groups during pretreatment, treatment, and posttreatment periods of the study. Also this table lists average fluid weight gains for the part of the treatment period during which the patient actually self-monitored fluid intake (Trt*) and the portion of the treatment period where the patient failed to regularly self-monitor (Trt-). The column on the right (Comp) lists the percentage of treatment days on which the patient returned completed self-monitoring records. The percentage of treatment days on which patients in Groups 1 and 2 brought in completed self-monitoring records was 56% and 77%., respectively.

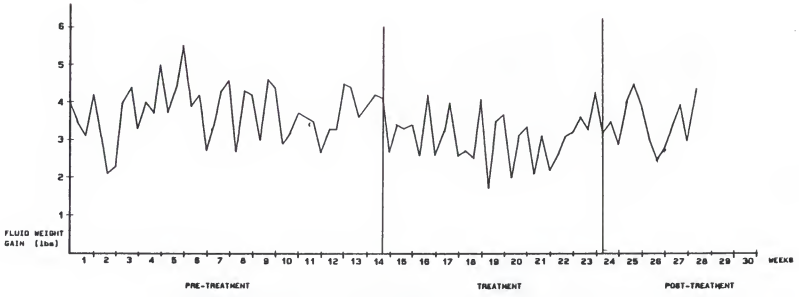

Figure 4.1 Graphs of Average Daily Fluid Weight Gain Data by Treatment for Group 1 Patients

GROUP 1
PATIENT #1

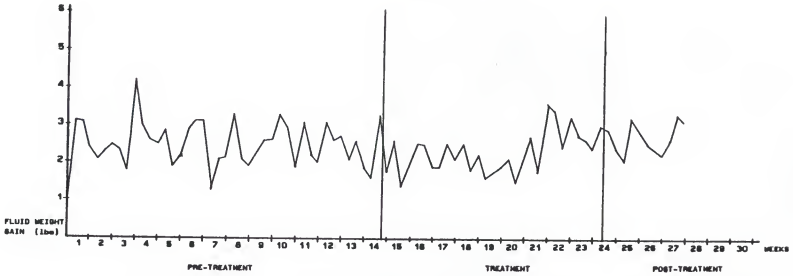

Figure 4.1--continued

GROUP 1
PATIENT #5

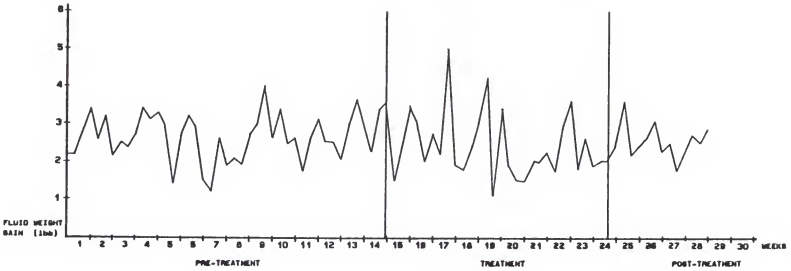

Figure 4.1--continued

GROUP 1
PATIENT #6

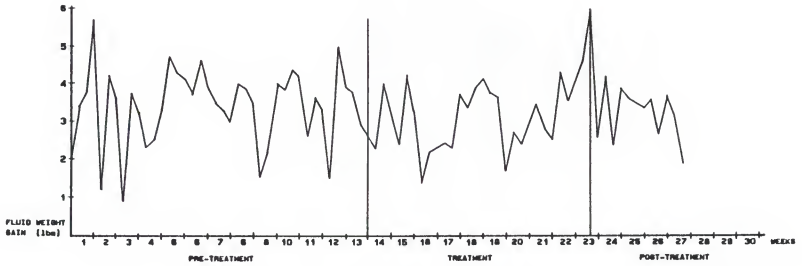

Figure 4.1--continued

GROUP 1
PATIENT #9

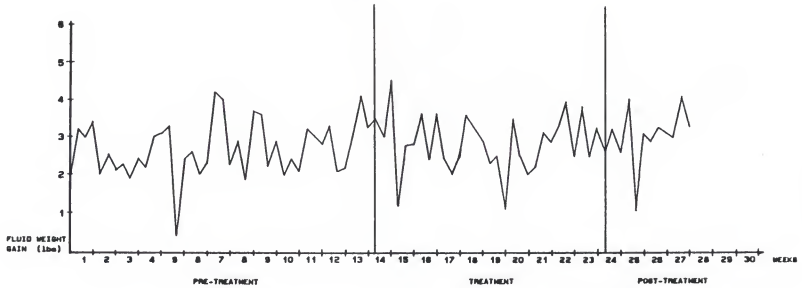

Figure 4.1--continued

GROUP 1
PATIENT #14

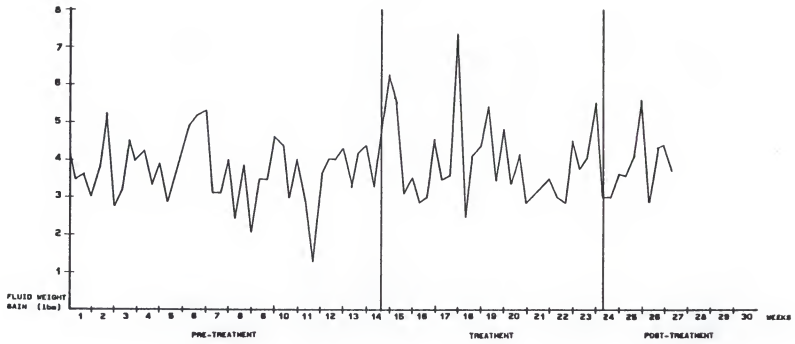

Figure 4.1--continued

GROUP 1
PATIENT #33

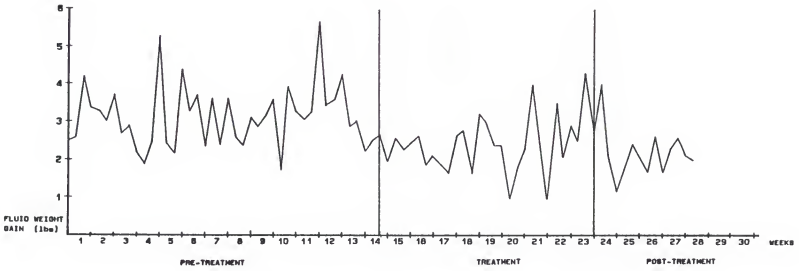

Figure 4.2 Graphs of Average Daily Fluid WFeight Gain Data by Treatment for Group 2 Patients

GROUP 2
PATIENT #2

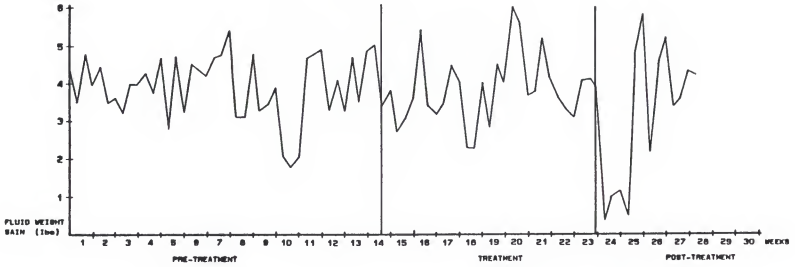

Figure 4.2--continued

GROUP 2
PATIENT #4

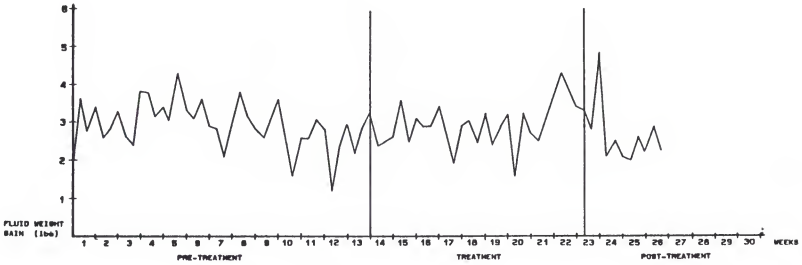

Figure 4.2--continued

GROUP 2
PATIENT #12

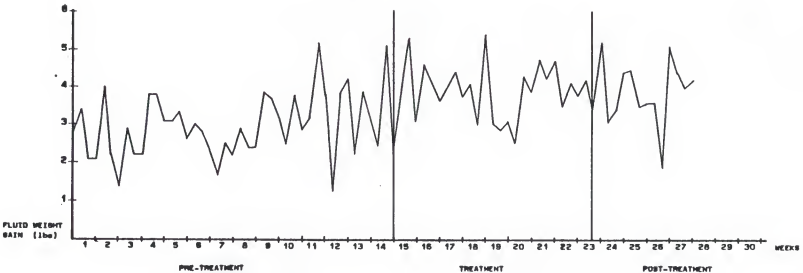

Figure 4.2--continued

GROUP 2
PATIENT #26

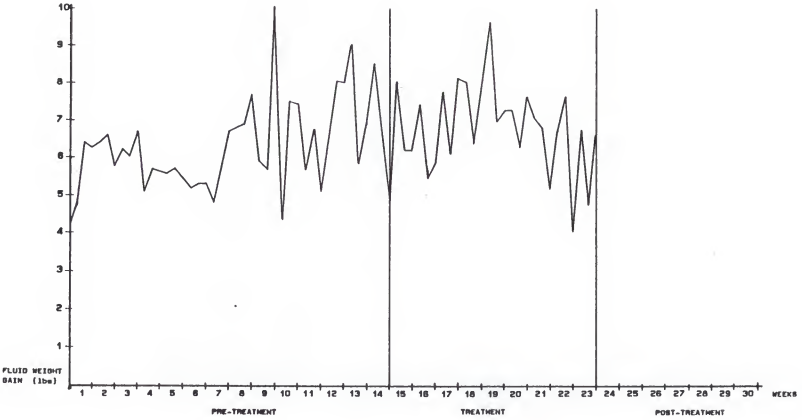

Figure 4.2--continued

GROUP 2
PATIENT #28

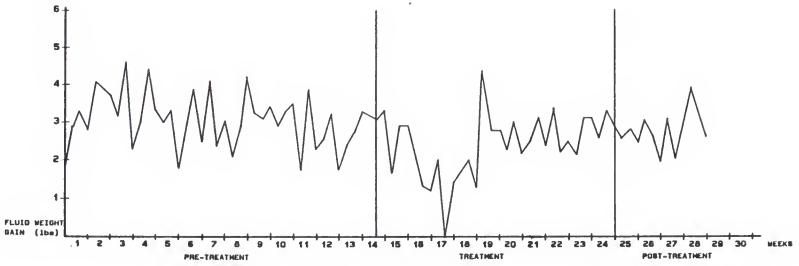

Figure 4.3 Graphs of Average Daily Fluid Weight Gain Data by Treatment for Group 3 Patients

GROUP 3
PATIENT #13

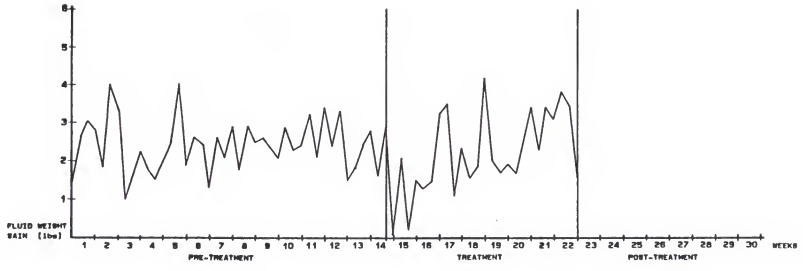

Figure 4.3--continued

GROUP 3
PATIENT #18

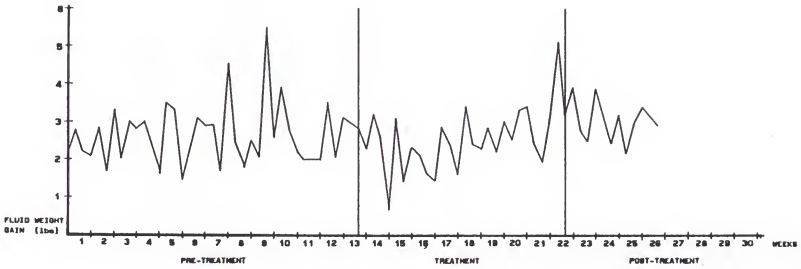

Figure 4.3--continued

GROUP 3
PATIENT #21

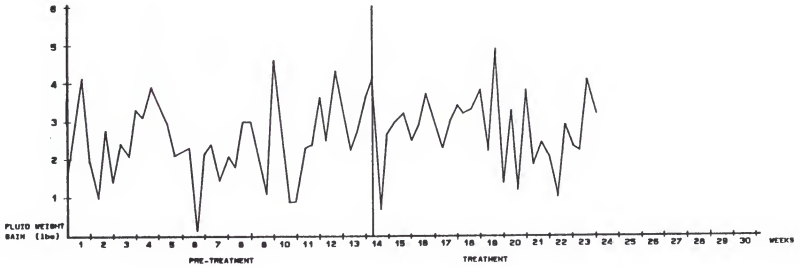

Figure 4.3--continued

GROUP 3
PATIENT #27

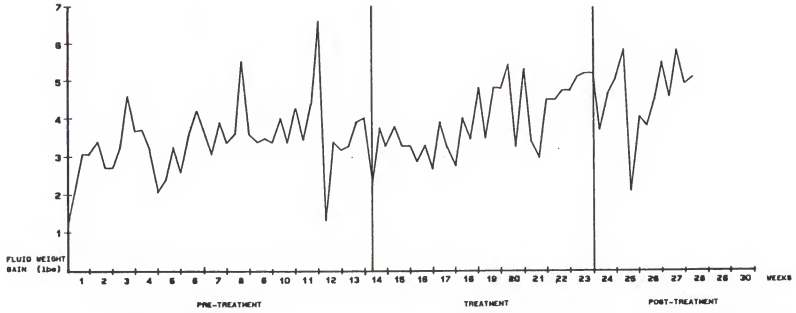

Figure 4.3--continued

GROUP 3
PATIENT #32

Table 4.14

Average Daily Fluid Weight Gains (lbs.) for Phase 2 Patients

	Pre	Trt	Trt*	Trt-	Post	Comp	Comp x
Group 1							
1	3.49	2.93	3.14	2.70	3.45	37%	
5	2.38	2.22	----	----	2.74	100%	
6	2.70	2.35	2.72	2.16	2.52	27%	
9	3.47	3.13	----	----	3.33	96%	
14	2.76	2.73	3.06	2.73	3.00	31%	
33	3.68	3.83	4.00	3.69	3.97	45%	
							56%
Group 2							
1	3.12	2.30	----	----	2.26	83%	
4	3.93	3.89	----	----	3.29	96%	
12	2.76	2.89	----	----	2.62	93%	
26	3.14	3.75	3.62	3.95	5.99	59%	
28	6.35	6.70	6.88	6.30	NA	55%	
							77%
Group 3							
13	2.95	2.34	-----	-----	2.78	-----	
18	2.37	2.13	-----	-----	NA	-----	
21	2.65	2.34	-----	-----	3.00	-----	
27	2.50	2.68	-----	-----	NA	-----	
32	3.49	3.92	-----	-----	4.34	-----	

Table 4.14--continued

Pre = Pretreatment

Trt = Treatment

Trt* = Portion of treatment period during which patient utilized self-monitoring as directed

Trt- = Portion of treatment period during which patient discontinued self-monitoring but remained in study

Post = Posttreatment

NA = Data not available

Comp = Percentage of treatment days when patient returned completed self-monitoring records

Comp x = Group mean of comps

Table 4.15 summarizes average fluid weight gain changes per day for each group between pretreatment and treatment, treatment and posttreatment, and pretreatment and posttreatment periods. Absolute and percentage changes are listed. Group 1 patients evidenced an average daily fluid weight gain decrease of .22 pounds (6.6%) from pretreatment to treatment periods of the study which was followed by an increase of .15 pounds (4.8%) during posttreatment after intervention 1 was discontinued. Overall a .07 (2.1%) pound decrease was observed between pretreatment and posttreatment. Group 2 patients demonstrated a .03 pound (0.8%) decrease in average daily fluid weight gain from pretreatment to treatment period of the study which was followed by a .34 pound increase (9.7%) in average daily fluid weight gain from treatment to posttreatment. Overall they evidenced a .31 pound decrease in

average daily fluid weight between pretreatment and posttreatment. Group 3, the no treatment control group, evidenced a .21 pound (6.4%) decrease in average daily fluid weight gain between pretreatment and treatment periods. This was followed by a .62 pound increase in average daily fluid weight gain (20.2%) between treatment and posttreatment periods. Overall, these patients showed a .41 pound increase (12.5%) in average daily fluid weight gain between pretreatment and posttreatment.

Table 4.15

Average Weight Change by Group across Periods of Study

Group	Pre-Trt		Trt-Post		Pre-Post	
	lbs	%	lbs	%	lbs	%
1	-0.22	-6.6	+.15	+4.8	-.07	-2.1
2	+.03	+0.8	+.34	+9.7	-.31	-8.9
3	-.21	-6.4	+.62	+20.2	+.41	+12.5

Table 4.16 presents the average daily fluid weight gains for patients in Groups 1, 2, and 3 across pretreatment, treatment, and posttreatment periods of the study.

Table 4.16

Mean Daily Fluid Weight Gains by Group across Periods of Study

	Period		
Group	Pre	Treatment	Post
1	3.33	3.11	3.26
2	3.48	3.51	3.17
3	3.28	3.07	3.69

A 3X3 repeated measures analysis of variance (ANOVA) was performed to test whether average daily fluid weight gains of Groups 1, 2, and 3 differed across pretreatment, treatment, and posttreatment periods. The results of this analysis are summarized in Table 4.17. No group, time, or interaction effect was found, indicating that none of the groups had significantly greater decreases in average daily fluid weight gains across pretreatment, treatment, and posttreatment periods, thus failing to support Research Hypothesis 5.

A 2X3 repeated measures analysis of variance (ANOVA) was also performed to test the effect of treatment versus no treatment (Groups 1 and 2 versus Group 3 [no treatment control]). The results of this analysis are presented in Table 4.18. No treatment, time, or interaction effect was evidenced, indicating that patients receiving a treatment did not significantly differ in their average daily fluid weight gains across treatment periods from patients not receiving any treatment. These results are consistent with the results of the 3X3 repeated measures ANOVA and also fail to support Research Hypothesis 5.

Table 4.17

Results of Group X Time Repeated Measures ANOVA

Source	df	Type III SS	MS	F-Value	p-level
Group	2	.19695673	.09847836	.09	.92
Error	10	11.07957271	1.10795727		
Time	2	.15387262	.07693631	.67	.52
Group X Time	4	.88327371	.22081843	1.93	.15
Error	20	2.29354208	.11467710		

Table 4.18

Results of Treatment Versus Non-Treatment X Time Repeated Measures ANOVA

Source	df	Type III SS	MS	F-Value	p-level
Treatment	1	3.47718630	3.47718630	1.10	.31
Error	16	50.55342465	3.15958904		
Time	2	.01546319	.00773160	.11	.90
Treatment X Time	2	.02329587	.01164794	.16	.85
Error	32	2.26142943	.07066967		

Research Hypothesis 6 states that there are statistically significant relationships between fluid compliance and self-efficacy at pretreatment, treatment, and posttreatment for patients in Group 1, Group 2, and Group 3 (control). Table 4.19 presents Pearson product-moment correlations for magnitude and confidence of patients' self-efficacy ratings and average daily fluid weight gains during pretreatment, treatment, and posttreatment.

Table 4.19

Relationship of Average Daily Fluid Weight Gains and Self-Efficacy Measures (n=11)

	Fluid Weight Gains		
Self-Efficacy	Pre	Treatment	Post
Magnitude			
Efficacy Expectations	-.50*	-.22	-.35
Outcome Expectations	.19	.17	.14
Total Self-Efficay	-.46	-.18	-.26
Confidence			
Efficacy Expectations	-.41	-.53*	-.52*
Outcome Expectations	-.53*	-.35	-.51*
Total Self-Efficay	-.52*	-.57*	-.15

*$p<.05$

These data indicate that there are statistically significant ($p<.05$) relationships between the magnitude of patients' efficacy expectations ($r = -.50$) and Total Self-Efficacy ($r = -.46$) and average daily fluid weight gain at

pretreatment but not during treatment or posttreatment. Patients' outcome expectations are positively related to fluid weight gains (r = .19; p<.1) but the correlations are weak and not statistically significant. All measures of patients' confidence in their self-efficacy are consistently but inversely related to average daily fluid weight gain, indicating higher confidence in self-efficacy is related to lower fluid weight gains. All correlation coefficients, except for confidence in total self-efficacy at posttreatment (r = -.15) are moderately high, ranging from r = -.41 to r = -.57.

The data presented in Table 4.20 indicate that changes in magnitude of efficacy expectations ratings are inversely related to changes in average daily fluid weight gain across the 3 periods of the study with correlation coefficients ranging from r = -.37 to r = -.56, as are changes in magnitude of outcome expectations (r = -.23 to r = -.64) and Total Self-Efficacy (r = -.38 to r = -.20). Changes in patients' confidence in their magnitude of self-efficacy ratings do not appear to have consistent relationships with their changes in fluid weight gains. Correlation coefficients for changes of confidence in efficacy expectations ratings and average daily fluid weight gain from pretreatment to treatment, treatment to posttreatment, and pretreatment to posttreatment ranged from r = -.09 to r = .25. For changes of confidence in outcome expectation subscale ratings and fluid weight gain, correlation coefficients ranged from r = -.01 to r = .29, and for Total Self-Efficacy and fluid weight gain, the measured correlation coefficients ranged from r = -.02 to r = -.24. These data provide partial support for Research Hypothesis 6. Magnitude of self-efficacy ratings are not strongly associated with average daily fluid weight gains, failing to support Research Hypothesis 6, whereas patients' confidence in the ratings are more strongly related. Changes in magnitude of patients'

self-efficacy ratings are consistently related to changes in average daily fluid weight, providing evidence supporting Research Hypothesis 6, whereas changes in patients' confidence in their ratings are not associated with changes in average daily fluid weight.

Table 4.20

Relationship of Change in Average Daily Fluid Weight Gain and Change in Self-Efficacy Measures (n=11)

	Change in Fluid Weight Gain		
Change in Self-Efficacy	Pre/Trt	Trt/Post	Pre/Post
Magnitude			
Efficacy Expectations	-.56*	-.49*	-.37
Outcome Expectations	-.23	-.64*	-.43
Total Self-Efficacy	-.38	-.20	-.28
Confidence			
Efficacy Expectations	.25	-.40	-.09
Outcome Expectations	-.01	.29	.02
Total Self-Efficacy	.24	-.24	-.02

*$p<.05$

CHAPTER V
DISCUSSION

A major objective of this study was the development of an instrument to assess the self-efficacy of hemodialysis patients to control their fluid intake. The Patient Self-Efficacy Questionnaire is a 9-item instrument which can be read to the patient by a member of the health care staff or self-administered in less than 3-5 minutes. Items I-6 form a subscale designed to assess patients' efficacy expectations or patients' beliefs that they can control their fluid intake in a number of potentially difficult situations. Items 7-9 form another subscale designed to measure outcome expectations or patients' beliefs that specific strategies can potentially be effective in assisting them to control their fluid intake. All items when considered together constitute a measure of total self-efficacy.

Bandura (1977a) has suggested that self-efficacy is most appropriately assessed by ascertaining strength, confidence, and generality of efficacy and outcome expectations. The PSQ is designed to measure strength and confidence of patients' efficacy and outcome expectations, whereas generality was assessed by determining the relationship of self-efficacy to control fluid intake to measures of other aspects of compliance.

Hypothesis 1 addresses an important aspect of any assessment instrument--reliability (Cronbach, 1970). There are two main types of reliability--internal consistency and stability. Stability or test-retest reliability is

a measure of the similarity of individuals' test responses for different administrations of the same test. Because the PSQ would be utilized to assess patient self-efficacy on multiple occasions across time, test-retest reliability was deemed the most appropriate measure of reliability.

The results of testing Research Hypothesis 1, which were presented in Tables 4.1, 4.2, and 4.3, indicate that the test-retest reliabilities of PSQ items, subscales, and the instrument as a whole are modest. One-week test-retest reliability coefficients for magnitude estimates of self-efficacy for PSQ items ranged from r = .42 to r = .83. For a one-month interval the item reliability coefficients ranged from r = .50 to r = .80. The Efficacy Expectation Subscale, composed of Items 1-6 and designed to measure the average strength (magnitude) of patients' beliefs that they can control fluid intake in a variety of situations, had one-week and one-month test-retest reliabilities of r = .80 and r = .76, respectively. The Outcome Efficacy Subscale, composed of Items 7-9 and designed to measure the average strength (magnitude) of patients' beliefs that particular strategies or interventions are effective means of assisting them in controlling fluid intake, had one-week and one-month test-retest reliability coefficients of r = .67 and r = .64, respectively. Total Self-Efficacy for the PSQ was r = .80 and r = .70 for one-week and one-month intervals, respectively.

The test-retest reliability coefficients obtained for Items 4 (control fluid intake at parties), 5 (control fluid intake when it is hot outside), and 6 (control fluid intake when patient is thirsty) are consistently the highest and are most likely the result of their specific content and the familiarity patients have with their drinking behavior in these situations. Item 3 (control fluid intake when eating out at a restaurant), although specific in nature, may have been a relatively rare and hence, an unfamiliar experience to some patients as 7 of the

patients specifically responded that they never or seldom ate out. This may help to explain the relatively low reliability of the item.

Items 1 and 2, which refer to fluid intake at home and away from home, respectively, were less reliable than expected. In retrospect, these items encompass a broad range of situations within and outside the home and potentially overlap with situations assessed by Items 3-6. Despite the relatively low test-retest reliability of Items 1 and 2, they may, nevertheless, serve a useful clinical function in assisting health care personnel in identifying the general nature of high risk non-compliance situations for individual patients.

Item 9 (If I got more encouragement to drink less liquid I would drink less.) has the lowest one-week test-retest reliability coefficient (r = .42) and one of the lowest test-retest reliability coefficients (r = .51) for a one-month interval. The reason for its relative unreliability is not clear, but it may reflect low confidence (38%) patients placed in their responses to this item.

Although the reliability coefficients obtained for the PSQ are modest, the test-retest reliability coefficients for the Efficacy Expectation and Outcome Expectation Subscales are more satisfactory, being r = .80 and r = .67, respectively, for the one-week interval, and r = .76 and r = .64, respectively, for the one-month interval. Total Self-Efficacy test-retest reliability coefficients were r = .80 for the one-week interval and r = .70 for the one-month interval.

Similar results (Table 4.2) were found for the reliability of patients' confidence in their PSQ item, subscale, and total self-efficacy ratings. Items 1, 2, 3, and 9 have relatively lower test-retest reliability coefficients, generally, than do Items 4-8. Efficacy Expectation and Outcome Expectation Subscales, as well as Total Self-Efficacy, have more adequate reliability than do the

individual items.

Surprisingly, some of the items and subscales have marginally higher test-retest reliability coefficients for 1-month intervals than for 1-week intervals. This probably represents sampling error as there is no theoretical rationale that would predict this apparent anomaly.

Table 4.3 presents comparative data for the reliability of magnitude and confidence estimates from compliant and non-compliant patients over one-week and one-months intervals. Very striking differences exist between the test-retest reliability coefficients for compliant versus non-compliant patients for both one-week and one-month intervals for the magnitude and confidence ratings of the Efficacy Expectation Subscale and Total Self-Efficacy of the PSQ. For example, non-compliant patients achieved 1-week test-retest reliability coefficients of $\underline{r}$ = .85 for magnitude of efficacy expectations and $\underline{r}$ = .80 for magnitude of total self-efficacy, whereas compliant patients achieved 1-week test-retest reliability coefficients of $\underline{r}$ = .49 and $\underline{r}$ = .56, respectively. One-month test-retest reliability coefficients for magnitude of efficacy expectations of non-compliant patients were $\underline{r}$ = .90 and $\underline{r}$ = .89 for magnitude of total self-efficacy, whereas compliant patients achieved 1-week and 1-month test-retest reliability coefficients of $\underline{r}$ = .26 and $\underline{r}$ = .45, respectively. Similar differences exist between reliability coefficients for confidence in efficacy expectations and total self-efficacy for compliant and non-compliant patients.

The differences for the Outcome Expectation Subscale are relatively small. For example, the reliability coefficients for magnitude of outcome expectations over a 1-week interval were $\underline{r}$ = .69 for non-compliant patients versus $\underline{r}$ = .66 for compliant patients. Similarly, the 1-month test-retest reliability coefficients for magnitude of outcome expectations were $\underline{r}$ = .86 for

non-compliant patients versus r = .76 for compliant patients.

One possible explanation of these data may be that non-compliant patients may receive more consistent feedback on their non-compliance and hence, may develop more consistent levels of self-efficacy. According to Bandura (1977a) individuals' self-efficacy is influenced by their experience. Feedback from experience is received from 4 sources: performance accomplishments, vicarious experience, verbal persuasion, and physiological states. It can be argued whereas non-compliant patients received consistent feedback from nurses and physicians concerning their non-compliance rarely are compliant patients recognized or reinforced for their adherence. In addition, physiological feedback in the form of feelings of distress associated with disequilibrium syndrome, which is typically exaccerbated by fluid non-compliance, is a frequent reminder to patients of their failure to control fluid intake.

Data exist to support this argument. When confidence in total self-efficacy is averaged across the six PSQ administrations, compliant patients were 32% confident in their ratings, whereas non-compliant patients rated their confidence at 53%. Although the difference in ratings is not statistically significant due to the small sample size and high variability in the ratings, they are, nonetheless, consistent with the explanation proposed.

These data, although certainly calling into question the usefulness of the PSQ with compliant hemodialysis patients, may not represent a signiticant problem in practice. Because the most likely clinical uses of the PSQ are the identification of high risk situations for fluid non-compliance and the assessment of preintervention and postintervention self-efficacy, the most critical and relevant reliability data is that of non-compliant patients.

A most important question remains to be answered. Is the reliability of the PSQ, its items and subscales adequate?

First, the adequacy of an instrument's reliability is always a relative matter. One must judge reliability with respect to other instruments available to assess self-efficacy and with respect to the application intended for the instrument. Because the PSQ is the only instrument available to measure hemodialysis patients' self-efficacy with respect to fluid intake, no comparison is possible.

Another approach to ascertaining the adequacy of the PSQ's reliability is to compare its reliability to that of other instruments designed to assess self-efficacy with respect to other behaviors in other populations. Unfortunately, when a survey of other existing instruments designed to assess self-efficacy is taken, a paucity of reliability data is found. Many articles (e.g., Ewart et al., 1983; Kirsch, 1982; McIntyre, Lichtenstein, & Mermelstein, 1983) utilized assessment instruments or techniques modeled after Bandura's (1977a) work in which items are constructed that appear to have high face validity to measure self-efficacy but for which no reliability data is obtained. Bandura (1977a) makes no mention of reliability at all.

A few relevant exceptions to this trend exist. DiClemente, Prochaska, & Gilbertini (1985) have designed a 31-item instrument to assess self-efficacy of cigarette smokers for high risk relapse situations. A mean inter-item correlation coefficient of $\underline{r} = .69$ was obtained with individual inter-item correlations ranging from $\underline{r} = .44$ to $\underline{r} = .93$. In another study using 115 undergraduate psychology students as subjects, Moe & Zeiss (1982) found 1-week test-retest reliability coefficients of $r = .25$ to $r = .88$ (mean $r = .65$) for items of their social skills self-efficacy questionnaire. The PSQ items,

subscales, and the instrument as a whole, have 1-week and 1-month stability coefficients of a similar magnitude. Ultimately, the adequacy or inadequacy of the psychometric properties of a measurement instrument is a determination that each clinician or researcher must make taking into account the purpose for which the instrument is used and the population with which the instrument is used.

Certain modifications of the PSQ may be helpful in improving its reliability and usefulness. Elimination of Items 1 (control fluid intake at home) and 2 (control fluid intake while away from home) and replacement of them with additional items that have greater situational specificity may improve its reliability. The situational content of the items could be empirically determined by soliciting additional input from hemodialysis patients. Furthermore, if the total number of items assessing efficacy expectations were increased, the reliability of the Efficacy Expectation Subscale and of the PSQ as a whole is likely to increase due to more comprehensive sampling of possible situations in which a patient may be confronted with a choice to drink or not drink fluid. Modification of Item 9(encouragement to drink less liquid), and possibly the other items constituting the Outcome Expectation Subscale, might also improve reliability of the PSQ. Feedback from nurses and patients indicate that some patients had difficulty understanding these items. For example, Item 7 might be modified to read, "If I had a way to keep track of how much liquid I drink (by carefully measuring it and writing it down each time I drink) I would be able to drink less."

Hypothesis 2 was designed to investigate the relationship between patient self-efficacy at the beginning of pretreatment and measures of compliance during pretreatment. Self-Efficacy Theory predicted that stronger

relationships would exist between self-efficacy for control of fluid intake and actual fluid intake as measured by average daily fluid weight gains than between self-efficacy for control of fluid intake and objective measurements of dietary and medication compliance. The behaviors necessary for medication and dietary compliance are related to, but not identical to, those necessary for fluid compliance. Hence, one would expect weaker correlations between self-efficacy for control of fluid intake and dietary and medication compliance than between self-efficacy for control of fluid and fluid compliance.

Self-efficacy appears to be significantly related to measures of compliance to the hemodialysis treatment regimens. Specifically, magnitude of the Efficacy Expectation Subscale and Total Self-Efficacy are inversely related to average daily fluid weight gain, r = -.33 and r = -.39, respectively, suggesting that individuals with high self-efficacy tend to evidence lower average daily fluid weight gains. The magnitudes of the Efficacy Expectation Subscale and of the Outcome Expectation Subscale are significantly related to Blood Urea Nitrogen (BUN) levels , a measure of dietary adherence, having correlation coefficients of r = -.41 and r = -.35, respectively. Compliance to diet, as measured by bicarbonate level is significantly related to the magnitude of the Efficacy Expectation Subscale of the PSQ (r = .44, p<.05) and Total Self-Efficacy (r = .47. p<.05). Self-efficacy for control of fluid intake was also weakly related to compliance to medication taking as measured by serum phosphorous level (r = -.18 to r = .19). Although two indicators of dietary compliance, BUN and bicarbonate levels, are related to self-efficacy for control of fluid intake, a third, serum potassium (r = -.13 to r = .23), is not related at statistically significant levels. Patients' confidence in their self-efficacy ratings are generally in the expected direction but the magnitude of the correlations is

relatively small and most were nonsignificant.

As was previously noted these results were largely anticipated. It was surprising, though, that BUN and bicarbonate levels were as strongly related to self-efficacy for control of fluid intake as was observed. This may reflect the general tendency of noncompliant patients to be noncompliant to more than one aspect of their treatment regimen as evidenced by significant intercorrelations between various measures of noncompliance (Ferraro, Dixon, & Kinlaw, 1986). Another possible explanation is that self-efficacy is a generalized construct rather than situation and behavior specific as Self-Efficacy Theory postulates. The relatively low correlations between outcome expectations and compliance measures may be due to the shortcomings previously discussed including patient difficulty in understanding PSQ items 7-9 (keeping track of fluid, controlling fluid intake, and encouragement, respectively) and the limited number of items included on this subscale.

In general, though, the results are consistent with the predictions of Self-Efficacy Theory. Patients with high self-efficacy tended to evidence lower fluid weight gains, BUN, and serum phosphorous levels but higher bicarbonate levels. High serum bicarbonate levels typically indicate better compliance. Bicarbonate acts as a buffer keeping the blood at an optimal PH (acid-base balance) (Seldin & Giebisch, 1985). When an individual is compliant and consumes the recommended amount and type of protein-rich foods, the blood has a normal PH and bicarbonate is unbound and freely available in the blood. When a patient is non-compliant to dietary protein restrictions (BUN is high) the body becomes acidotic. In order to neutralize the acidotic state of the body, bicarbonate combines with the excess nitrogen available due to consumption of poor quality or excess protein. Hence its

blood level decreases with non-compliance and increases with compliance.

Research Hypothesis 3 addressed the relationship between selected patient characteristics and self-efficacy. Age was significantly related to magnitude of scores on the Efficacy Expectation Subscale and Total Self-Efficacy scores with $r = .41$ and $r = .42$ ($p<.05$), respectively. Age was also associated with patient confidence in their Outcome Expectation Subscale ratings and Total Self-Efficacy ratings which approached significance with correlation coefficients of $r = .32$ and $r = .34$ ($p<.09$), respectively. Thus, older patients tended to have higher self-ratings of self-efficacy and also have more confidence in their self-efficacy ratings.

Education was inversely related to the magnitude of the Outcome Expectation Subscale ($r = -.57$, $p<.05$) and showed weaker inverse relationships with the magnitude of the Efficacy Expectation Subscale and Total Self-Efficacy scores ($r = -.33$; $r = -.37$; $p<.09$). Patients' confidence in their ratings of Outcome Expectations were inversely related to educaton ($r = -.57$; $p<.05$). Time on dialysis, transplant status, sex, race, presence of a support person or persons, marital status, and presence of air conditioning in the home were unrelated to any of the self-efficacy measures.

Most studies of self-efficacy and health related behaviors have neglected to investigate the relationships between self-efficacy and various patient characteristics. This may be due to the expectation on the part of researchers that because self-efficacy is theoretically situation and behavior specific, it is independent of patient characteristics. Only one other study reviewed for the preparation of this dissertation investigated the relationship between patient characteristics and self-efficacy. DiClemente (1981) found no relationships between smokers' characterisctics such as age, education, and

number of years smoking, and self-efficacy.

The fact that the patient characteristics, age and education, are related to self-efficacy may be significant. Older individuals in this study appear to have higher levels of self-efficacy than younger subjects. It is possible that as individuals age they gain broad experience in life and a sense of personal competency which may impact their self-efficacy for successful control of fluid intake. Another possible explanation that may explain this relationship is that older individuals may have a response set to please the researcher. Informal observation of and interaction with the predominantly lower SES patients participating in this study indicate that these patients often minimize their health problems, are intimidated by health care professionals, and tend to respond in socially acceptable ways that they believe will please their health care providers. This tendency appears to be more prominent among older patients.

Education appears to be inversely related to the self-efficacy measures utilized in this study. Thus, individuals with higher levels of education have lower self-efficacy. Perhaps more highly educated individuals were either (1) more accurate in their appraisal of their poor compliance and low self-efficacy or (2) more comfortable reporting low self-efficacy.

Hypothesis 4 examined the relationships between patient characteristics and compliance. This area has been extensively investigated by others (e.g., Basta, 1981; Borkman, 1981; Czaczkes & Kaplan De-Nour, 1978; Olsen, 1983). The results of this study, that no significant relationships exist between sex, race, time on dialysis, age, marital status, presence of a support system, and compliance to fluid restrictions, are generally consistent with prior research findings (Olsen, 1983). It is interesting that two situational

factors, namely, transplant status and presence of air-conditioning in the home, were not found to be related to compliance to fluid restrictions. The fact that transplant status is not associated with compliance suggests that preexisting patient compliance should not be expected to improve without intervention once a patient becomes a transplant candidate. To adequately test this notion, though, following both compliant and non-compliant patients before and after placement on a transplant list will be necessary.

The inclusion of the situational variable, presence of air-conditioning in the home, was prompted by the belief that air-conditioning would increase patient comfort and possibly decrease patient thirst. Both are areas of difficulty for most patients, having received magnitude of efficacy expectation scores of .68 and.73, respectively, during baseline. These scores indicate that patients feel least self-efficacious toward fluid control in the situations of discomfort from heat and thirst. Perhaps the hemodialysis patients participating in this study did not utilize the air-conditioning present in their homes due to financial constraints. If this data were sought again, usage patterns should be assessed.

Hypothesis 5 investigates the effects of the two behavioral intervention packages on patient compliance to fluid restrictions compared with compliance of the control group. Group 1 self-monitored their fluid intake daily. Group 2 self-monitored fluid intake daily and also received structured praise from nurses for decreases in fluid weight gain. Control group patients continued to receive routine dialysis treatment.

Visual inspection of the graphs of daily fluid weight gain across time (Figures 4.1, 4.2, and 4.3) for patients in Groups 1, 2, and 3 reveals no consistent patterns of fluid weight gain reductions during treatment or

posttreatment that are clinically significant. Group 1 Patients 1, 6, and 9 show average fluid weight gain reductions of from 0.34 to 0.56 lbs./day. Patient 2 in Group 2 evidenced the most dramatic daily fluid weight gain reduction of 0.81 lbs./day which was maintained during posttreatment. Group 2 Patients 4 and 12 also evidenced average daily fluid weight gain reductions of .86 and .14 pounds, respectively, from pretreatment to posttreatment, but showed little change during treatment. All other Group 1 and Group 2 patients either increased their average daily fluid weight gains during treatment and/or posttreatment or evidenced no change in fluid weight gains during these periods.

It is noteworthy that 3 of the 5 control patients reduced their average daily fluid weight gains without explicit knowledge of the treatments Group 1 or 2 were using. Of significance also is the fact that 1 patient in Group 1, 3 patients in Group 2, and 2 patients in Group 3 increased their average daily fluid weight gains during treatment compared to pretreatment. In addition, marked variability in daily fluid weight gains was evidenced by most patients in the study. Overall, the variability of patient average daily fluid weight gains was unaffected by either Treatment 1 or 2.

When the group means of average daily fluid weight gains were compared using a 3X3 repeated measures (groupXtime) ANOVA, no group, time or group X time interaction effects were found. A repeated measures (2X3) ANOVA of treatment versus no treatment (Groups 1 and 2 versus control) X time also revealed no treatment, time, or interaction effect. The data presented in Table 4.15 indicate that Group 1 as a whole averaged 6.6% reduction in average daily fluid weight gain, Group 2 averaged less than a 1% reduction, and the control group averaged 6.4% weight reduction between

pretreatment and treatment. Clearly these data indicate that neither Group 1 nor Group 2 significantly responded to Treatments 1 or 2, respectively. Table 4.15 data reveal minimal pretreatment to posttreatment average daily fluid weight gain reductions but these may be artifacts and in any case are without clinical or statistical significance.

The data analyses presented appear to indicate that the behavioral interventions utilized in this study were not effective. However, before dismissing these strategies as ineffective some observations concerning this research are required. Non-compliance to fluid restrictions has been recognized as a widespread and resistant problem (Blackburn, 1977; Cheek, 1982). Many of the patients participating in Phase 2 of this study had been on hemodialysis for a long time (mean time on hemodialysis = 52 months; range 6-240 months) and had been consistently non-compliant during that period. These patients have proven remarkably resistant to past attempts to persuade, educate, cajole, coerce, or otherwise modify their non-compliance to their treatment regimens. Patient participation, as measured by the return of completed though not necessarily accurate, fluid self-monitoring records was questionable. Group 1 patients' mean rate of fluid record return was 56% with a range of 31-100%. Thus, patients on the average brought in approximately one out of every two records. It is likely that 56% represents an overestimate of the true rate of self-monitoring when one considers that some patients admitted to occasionally completing fluid record sheets at or on the way to the dialysis unit. No data was collected on the frequencies of these or similar behaviors. Group 2 patients were somewhat more consistent in returning completed fluid records as they achieved a 77% return rate with a range of 55-96%.

In practice most patients did not uniformly neglect self-monitoring and recording and/or neglect to return their completed records to the unit. Instead, most were consistent at the beginning of the treatment period but once they failed to return their first record, their rate of fluid record return quickly approached zero. For those patients for whom return rates differed markedly from 100% (less than 90%), treatment period average daily weight gains were computed for that period during which self-monitoring was performed by the patient and that part of treatment during which the patient had discontinued self-monitoring. These data are listed as Trt* and Trt-, respectively, in Table 4.14. For five of the six patients for which this analysis is applicable, no decrease in average daily fluid weight gain was observed for the period during which the patient self-monitored. Only for the period of treatment following discontination of the self-monitoring were small decreases in average daily fluid weight gain observed. This effect disappeared at posttreatment. Self-monitoring appears to have no immediate measurable effect but may possibly have a delayed effect. It is possible that the small, apparently delayed effects on fluid weight gain are due to extraneous factors not related to treatment.

Also noteworthy is the fact that Group 2 patients, who generally received additional attention from the hemodialysis unit staff in the form of increased frequency and duration of contact, as well as a potentially more salient intervention, appeared to continue self-monitoring 21% longer than Group 1 patients (77% versus 56%). Thus, increased patient participation in the project may be fostered by Intervention 2 but only marginal improvements in compliance accrued.

During the course of the study several extraneous factors which were not quantified impacted on the study participants. First, three of the nurse

participants in the study left the unit to pursue employment elsewhere. This was in part due to personal considerations but also reflected ongoing staff morale and unit administration issues. Simultaneously unit policies affecting patient eating and drinking while on dialysis and in the unit were implemented without prior consultation with patients. This further exacerbated low staff morale. It also angered patients and may have affected patient compliance adversely. During this period of staff turnover, there were increased work demands placed on the remaining staff, further lowering morale.

In addition to impacting staff morale, the shortage of staff also affected staff participation in scheduled study tasks such as collecting fluid records, graphing behavioral control data and praising patients. This is reflected in the fact that nurses correctly recorded and/or praised patients in Group 2 on only 77% of the occasions possible. Despite the stressors the nurses and technicians experienced during this period, they diligently attempted to fully implement study procedures but, unfortunately, were unable to do so due to the demanding unit circumstances. Circumstances such as these, although unfortunate and unanticipated, were nevertheless disruptive to the study. They undoubtedly contaminated the integrity of treatment procedures and may have negatively impacted patient compliance to fluid restrictions.

It is clear from the preceeding discussion that neither Intervention 1 nor 2 received an adequate trial during this study. For this reason, no conclusions concerning the effectiveness of either treatment will be drawn.

Nevertheless, anecdotal evidence from nurses and patients suggests that the reinforcers available for patients were not salient. Social praise is a secondary reinforcer and is reportedly "the most powerful and versatile of all secondary reinforcers" (Wilson & O'Leary, 1980, p. 100). Perhaps praise from

nurses at the dialysis unit was not a sufficiently powerful reinforcer to alter preexisting patient behaviors and response-reinforcement contingencies. After all, a maximum of one or two statements of "good job" or "way to go" from a unit nurse or technician three times per week may lack sufficient reinforcing properties to offset the powerful states of physiological deprivation (thirst) experienced by patients or the well-established patterns of excessive fluid intake characteristic of these hemodialysis patients. Inspection of the graphs of individual patient's average daily fluid weight gain data reveals that behavioral control of fluid intake was never achieved, except in Patient 2 in Group 2. Hence, the naturally reinforcing properties of good compliance and social praise from nurses and other significant individuals never became operative. Strategies must be developed that act quickly and powerfully on individuals with minimal motivation if non-compliant hemodialysis patients are to be successful in reducing their fluid intake or modifying other non-compliant behaviors.

A possible reinforcer which might be more effective with this population is money. Potential reinforcers are most effective when they have sufficient reward properties to induce an individual to work for them. Reinforcers are also most effective when used with an organism that is experiencing a state of deprivation. In retrospect, social praise may have lacked both of these properties, whereas money may possess both characteristics. It can be exchanged for many items and/or services, thus increasing the likelihood that it would be meaningful or rewarding to the patient. Many of the patients have significant limitations on their available financial resources. Also, their health is poor which prevents full or even part-time employment. In addition, patients often lack marketable skills and have limited education. In this state of relative

financial deprivation, reinforcing patients' compliant behavior with small sums of money, for example, $5-10/week, might be effective. Past research has indicated that token economies have been effective in improving the compliance of children on hemodialysis (Magrab & Papadopoulou, 1977).

The preliminary results of Tucker and her collaborators (personal communication, June, 1988) suggest that hemodialysis patients will increase self-monitoring behavior when rewarded monetarily on a variable interval schedule which was gradually faded. Her results, together with the data generated by this study, suggest that self-monitoring may not be a powerful compliance altering strategy and should not be the target behavior reinforced. Instead, future research utilizing more salient reinforcers, such as tokens, script, or actual cash should directly target fluid weight gain and reward patients for decreases in this measure of compliance.

For the non-compliant patients who participated in Phase 2 of the study the magnitude of their Efficacy Expectation Subscale ratings and their Total Self-Efficacy ratings were strongly inversely related to their pretreatment average daily fluid weight gains and less strongly related to their fluid weight gains during treatment and posttreatment. Thus, it is clear that, at least prior to treatment, those patients having higher self-efficacy (Efficacy Expectation and Total Self-Efficacy) ratings tended to be more compliant as would be predicted by Self-Efficacy Theory.

The magnitude of patients Outcome Expectation Subscale ratings are weakly related in a positive direction to average daily fluid weight gains. Patients with lower outcome expectations don't believe that the strategies such as keeping track of fluid or methods of controlling fluid intake are or will be effective. These patients tended to have lower weight gains. Self-Efficacy

Theory would predict the opposite. Some of the patients expressed the opinion that the utilization of techniques or "tricks" would not help them control their fluid intake. They stated that if they wanted to drink fluid they would do so with or without the technique. In effect, they were disagreeing with a basic assumption underlying Self-Efficacy Theory, i.e., that self-efficacy is dependent on efficacy and outcome expectations. These patients were postulating a simple motivational theory wherein motivated patients will do the common sense or medically advised behaviors necessary to restrict their fluid intake to the prescribed level. "Will power" was the key, not techniques which are useless unless practiced by a motivated individual. Perhaps these patients, who tended to be somewhat less non-compliant than others in Phase 2 of the study, indicated low outcome expectations toward fluid intake control strategies, thus producing overall weak positive correlations with fluid weight gain. Future research is needed to address this issue. In addition, assessment of patient motivation should be included in future studies.

Confidence of patients in their self-efficacy ratings was generally more strongly related to fluid weight gain than were magnitude of self-efficacy ratings. Those patients with higher confidence in their ratings tended to evidence lower weight gains. This is consistent with Self-Efficacy Theory. Bandura (1977a) proposes that environment feedback in the form of performance accomplishments is a primary influence on individuals' self-efficacy. Patients who have more frequent low interdialysis weight gains and who get feedback on these from unit staff members, significant others, and pretreatment weigh-ins, tend develop high self-efficacy. Consistency in performance and feedback leads to stable and generalized self-efficacy (Bandura, 1977a).

Interestingly, patients' expressed confidence in their Outcome Expectation Subscale ratings, like their magnitude of Outcome Expectation Subscale ratings, was positively related to average daily fluid weight gains, indicating that more confident patients were less compliant. Although the magnitude of the correlations is small and statistically non-significant, it is inconsistent with Self-Efficacy Theory. Lee (1984), contrary to Bandura's (1977a) findings, has reported that outcome expectations are less consistently and more weakly related to mastery behaviors in snake phobic individuals. It is possible that a similar relationship exists for the more complex behaviors necessary for compliance.

Changes in patients' magnitude of efficacy expectations and total self-efficacy from pretreatment to treatment and from treatment to posttreatment periods are inversely related to their changes in fluid weight gain over the same periods. These relationships are congruent with Self-Efficacy Theory in that one would predict that increases in self-efficacy measures would be reflected in decreases in average fluid weight gain, whereas decreases in self-efficacy measures would be reflected in increases in fluid weight gains. Changes in patients' confidence in their self-efficacy ratings do not appear to be consistently related to changes in their fluid weight gain data.

Limitations of the Study

There are 3 major limitations to this study:

1. Because only one dialysis unit was utilized in this study, the results of this study may not be representative of other dialysis units or dialysis units in general.

2. A relatively small sample size of hemodialysis patients was available for this study, therefore, the types of analyses performed and/or their inferential power was limited. The relatively high rate of patient drop-out also contributed significantly to this limitation.
3. The planned duration of the treatment period of this study was 8 weeks but several patients discontinued treatment prematurely, thus effectively shortening the duration of the treatment interventions.

Conclusions

Although this has been a complex study which unfortunately was adversely affected by uncontrolled influences, much useful data were generated. The analyses of these data has allowed several conclusions to be reached.

First, the Patient Self-Efficacy Questionnaire (PSQ) appears to be a fairly reliable instrument for assessing the self-efficacy of hemodialysis patients with respect to the control of fluid intake. Although its total reliability and that of its Efficacy and Outcome Expectation Subscales are adequate and the equal of other instruments designed to measure self-efficacy, the PSQ could benefit from continued development. Additional items assessing efficacy expectations should be developed. The development of these items should include patient input on situations in which they find it difficult to control their fluid intake. Based on feedback from patients and dialysis unit staff, the removal of Items 1 and 2 (control of fluid intake at home and away from home, respectively) and the revision of Items 7 (keeping track of fluid intake) and 9 (encouragement to drink less fluid) should should also be considered. Prior to any major revision

of the PDQ, the instrument should be administered to a larger group of hemodialysis patients than was utilized in this study.

Second, self-efficacy with respect to control of fluid intake appears to be related to compliance to fluid restrictions. Patients with higher self-efficacy tended to display better fluid compliance, whereas patients with lower self-efficacy tended to evidence poorer fluid compliance. Self-efficacy appears to be moderately generalized as patients self-efficacious with respect to fluid control also evidenced better dietary and medication compliance in addition to their fluid compliance. Future research should assess self-efficacy and compliance to dietary, fluid, and medication regimens to better understand the relationships involved.

Third, as predicted by Self-Efficacy Theory, most patient characteristics were not related to self-efficacy. Exceptions were demonstrated, though, as age and education of hemodialysis patients were related to measures of self-efficacy. Also, situational factors, such as transplant status and presence of air-conditioning in the home, which might be expected to be related to self-efficacy, were not.

Fourth, as demonstrated in past research, patient characteristics were not related to compliance to fluid restrictions.

Fifth, the cognitive-behavioral intervention packages utilized in this study did not appear to be effective in decreasing patient non-compliance to fluid restrictions. This may be the result of a combination of factors including intervention ineffectiveness, compromised treatment integrity, and the disruptive effect of extraneous factors beyond the researcher's control. As a result no firm conclusions can be drawn concerning the effectiveness of the interventions utilized in this study. Future research should incorporate

measures to further safeguard treatment integrity and maximize nurse and patient follow-through of study procedures.

Sixth, changes in self-efficacy across time appear to be related to changes in compliance consistent with Self-Efficacy Theory predictions.

Overall, the data in this study appears to support the applicability of Self-Efficacy Theory to the description and explanation of the compliance behavior of hemodialysis patients.

Suggested Future Research

This study has indicated some areas in which future research may be appropriate. These include

1. Further development of the PSQ including additional reliability and validity determinations with a larger patient sample for possible revision and/or replacement of existing items is suggested.
2. Instruments should be developed to assess hemodialysis patients' self-efficacy with respect to dietary and medication adherence.
3. More powerful treatment interventions to alter compliance and self-efficacy among hemodialysis patients should be developed.
4. Future research utilizing larger sample size should carefully investigate the relationship of changes in self-efficacy with respect to fluid, dietary, and medication regiments, and changes in compliance to fluid, dietary, and medication regimens across time.
5. Although the results of this study suggest an association between changes in self-efficacy and changes in fluid compliance, this research did not investigate whether changes in self-efficacy

precede or follow changes in compliance. This question would constitute a fruitful area for future research.

APPENDIX A

PATIENT SELF-EFFICACY QUESTIONNAIRE

Directions

Please read each of the following sentences. Please circle "YES" if you think that the sentence is true for you now. Circle "NO" if you do not think it is true for you now.

Below each sentence are 10 numbers (10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%) which tell how sure you are about your "YES" or "NO" answer. Please circle the number that tells how sure you are. For example, if Mary is very sure that she can control how much liquid she drinks when she is at home she might circle 80%. Joe might not be very sure of his answer, so he might circle 20%. PLEASE CIRCLE THE NUMBER THAT TELLS HOW SURE YOU ARE ABOUT YOUR ANSWER.

YES NO I can control how much liquid I drink when I'm at home.

10%---20%---30%---40%---50%---60%---70%---80%---90%---100%

YES NO I can control how much liquid I drink on a day when I'm away from home.

10%---20%---30%---40%---50%---60%---70%---80%---90%---100%

YES NO I can control how much liquid I drink on a day when I eat out at a restaurant.

10%---20%---30%---40%---50%---60%---70%---80%---90%---100%

YES NO I can control how much liquid I drink on a day when I go to a party.

10%---20%---30%---40%---50%---60%---70%---80%---90%---100%

YES NO I can control how much liquid I drink on a day when it is hot outside.

10%---20%---30%---40%---50%---60%---70%---80%---90%---100%

YES NO I can control how much liquid I drink on a day when I am thirsty.

10%---20%---30%---40%---50%---60%---70%---80%---90%---100%

YES NO If I had a way to keep track of how much liquid I drink I would be able to drink less.

10%---20%---30%---40%---50%---60%---70%---80%---90%---100%

YES NO If I had a way to control how much liquid I drink I would drink less.

10%---20%---30%---40%---50%---60%---70%---80%---90%---100%

YES NO If I got more encouragement to drink less liquid I would drink less.

10%---20%---30%---40%---50%---60%---70%---80%---90%---100%

APPENDIX B

INFORMED CONSENT TO PARTICIPATE IN RESEARCH

J. HILLIS MILLER HEALTH CENTER
UNIVERSITY OF FLORIDA
GAINESVILLE, FLORIDA 32610

You are being asked to volunteer as a participant in a research study. This form is designed to provide you with information about this study and to answer any of your questions.

1. TITLE OF RESEARCH STUDY

The Effects of Behavioral Interventions on Self-Efficacy and Compliance of Hemodialysis Patients--Phase I

2. PROJECT DIRECTOR

Name: Carolyn M. Tucker, Ph.D.
Telephone Number: 392-1532

3. THE PURPOSE OF THE RESEARCH

One purpose of Phase 1 of this project is to help your doctors better understand the problems patients have controlling how much liquid

they drink. A second purpose is to determine in what kind of situations patients have the most trouble drinking less liquid. A third purpose is to develop a short, 5-minute questionnaire that can help patients and doctors identify situations in which patients have trouble controlling how much liquid they drink. Patients can then be helped to drink less liquid in those situations.

4. PROCEDURES FOR THIS RESEARCH

Patients participating in Phase 1 of this project will be asked to complete a short questionnaire. You will do this 3 times during a 4-week period. It will take about 5 minutes each time and you can do it during dialysis. If you would like help filling out the questionnaire one of the nurses will help you. In addition, the researchers will obtain some information (for example, your name, age, sex, how long you've been on hemodialysis, and monthly lab results) from your medical records. Your name will not be written on the questionnaire nor on the information from your medical records so that your rights to confidentiality will be protected.

5. POTENTIAL RISKS OR DISCOMFORTS

If you wish to discuss these or any other discomforts you may experience, you may call the Project Director listed in #2 of this Form.

There are no risks or discomforts anticipated for patients participating in Phase 1 of this project.

6. POTENTIAL BENEFITS TO YOU OR TO OTHERS

By participating in this project you will benefit indirectly as a result of your doctors' better understanding of situations in which patients have difficulty controlling how much liquid they drink. Patients can then be helped to drink less liquid in situations which are difficult for them.

7. ALTERNATIVE TREATMENT OR PROCEDURES, IF APPLICABLE

There are no alternative treatments or procedures.

8. GENERAL CONDITIONS

I understand that I will _____/will not _____ receive money for my participation in this study. If I am compensated, I will receive _____

_____.

I understand that I will _____/will not _____ be charged additional expenses for my participation in this study. If I am charged additional expenses these will consist of _____

_____.

I understand that I am free to withdraw my/my child's consent and discontinue participation in this research project at any time without this decision affecting my/my child's medical care. If you have any question regarding your rights as a subject, you may phone 392-3063.

In the event of my/my child's sustaining a physical injury which is proximately caused by this experiment, professional medical care received at the J. Hillis Miller Health Center exclusive of hospital expenses will be provided me without charge. This exclusion of hospital expenses does not apply to patients at the Veterans Administration Medical Center (VAMC) who sustain physical injury during participation in VAMC-approved studies. It is understood that no form of compensation exists other than those described above.

I also understand that the University of Florida and the Veterans Administration Medical Center will protect the confidentiality of my records to the extent provided by law. The Study Sponsor, Food and Drug Administration or either Institutional Review Board may ask to review my records, however, the records will remain confidential as only a number and initial will be used.

---

9. SIGNATURES

I have fully explained to _____

the nature and purpose of the above-described procedure and the benefits and risks that are involved in its performance. I have answered and will answer all questions to the best of my ability. I may be contacted at telephone number _____.

_____

Signature of Principal or Co-Principal Investigator Obtaining Consent Date

I have been fully informed of the above-described procedure with its possible benefits and risks and I have received a copy of this description. I have given permission of my/my child's participation in this study.

Signature of Patient or Subject or Relative or Parent or Guardian (specify) Date

Signature of Child (7 to 17 yrs. of age) Date

Signature of Witness Date

APPENDIX C

INFORMED CONSENT TO PARTICIPATE IN RESEARCH

J. HILLIS MILLER HEALTH CENTER
UNIVERSITY OF FLORIDA
GAINESVILLE, FLORIDA 32610

You are being asked to volunteer as a participant in a research study. This form is designed to provide you with information about this study and to answer any of your questions.

1. TITLE OF RESEARCH STUDY

The Effects of Behavioral Interventions on Self-Efficacy and Compliance of Hemodialysis Patients--Phase II

2. PROJECT DIRECTOR

Name: Carolyn M. Tucker, Ph.D.
Telephone Number: 392-1532

3. THE PURPOSE OF THE RESEARCH

One purpose of Phase 2 of this project is to help your doctors better understand the problems patients have controlling how much liquid

they drink. Another purpose is to teach you a way of controlling the amount of liquid that you drink that may help you reduce your fluid weight gain.

4. PROCEDURES FOR THIS RESEARCH

You will learn one of 2 ways to help you drink less liquid. One way will involve measuring and recording the liquid that you drink. The other way will involve learning just how what you drink is related to your weight gain between treatments. Some patients will wait a short time and then learn the way that works best. The way you learn and when it will be determined by chance.

You will also be asked to answer the same questions you did in Phase 1, two more times. Phase 2 of this project will last 1 month. One month after Phase 2 is over, you will have a chance to learn the best way to drink less liquid. Your name will not be written on the questionnaire nor on the information from your medical record so that your right to confidentiality is protected.

5. POTENTIAL RISKS OR DISCOMFORTS

If you wish to discuss these or any other discomforts you may experience, you may call the Project Director listed in #2 of this Form.

There are no risks or discomforts anticipated for patients participating in Phase 2 of this project.

6. POTENTIAL BENEFITS TO YOU OR TO OTHERS

Benefits that you and other patients may gain from participating in this project are:

1. less discomfort during treatment due to removing a large amount of fluid
2. fewer medical problems due to drinking too much liquid
3. reduced medical costs due to unnecessary stays in the hospital and medical problems due to drinking too much liquid
4. development of ways to help patients drink less liquid and gain less weight between dialysis treatments
5. safer hemodialysis from a heart, lung and blood pressure standpoint.

7. ALTERNATIVE TREATMENT OR PROCEDURES, IF APPLICABLE

There are no alternative treatments or procedures.

8. GENERAL CONDITIONS

I understand that I will _____/will not _____ receive money for my participation in this study. If I am compensated, I will receive _____

_____.

I understand that I will _____/will not _____ be charged additional expenses

for my participation in this study. If I am charged additional expenses these will consist of _____

_____.

I understand that I am free to withdraw my/my child's consent and discontinue participation in this research project at any time without this decision affecting my/my child's medical care. If you have any question regarding your rights as a subject, you may phone 392-3063.

In the event of my/my child's sustaining a physical injury which is proximately caused by this experiment, professional medical care received at the J. Hillis Miller Health Center exclusive of hospital expenses will be provided me without charge. This exclusion of hospital expenses does not apply to patients at the Veterans Administration Medical Center (VAMC) who sustain physical injury during participation in VAMC-approved studies. It is understood that no form of compensation exists other than those described above.

I also understand that the University of Florida and the Veterans Administration Medical Center will protect the confidentiality of my records to the extent provided by law. The Study Sponsor, Food and Drug Administration or either Institutional Review Board may ask to review my records, however, the records will remain confidential as only a number and initial will be used.

_____

9. SIGNATURES

_____

I have fully explained to _____

the nature and purpose of the above-described procedure and the benefits

and risks that are involved in its performance. I have answered and will answer all questions to the best of my ability. I may be contacted at telephone number _____.

_____

Signature of Principal or Co-Principal Investigator Obtaining Consent Date

I have been fully informed of the above-described procedure with its possible benefits and risks and I have received a copy of this description. I have given permission of my/my child's participation in this study.

_____

Signature of Patient or Subject or Relative or Parent or Guardian (specify) Date

_____

Signature of Child (7 to 17 yrs. of age) Date

_____

Signature of Witness Date

APPENDIX D

PATIENT DEMOGRAPHIC FORM

Patient Code Number _____

1. Age _____
2. Gender: M ____ F ____
3. Race/Ethnicity: White ____ Black ____ Other ____
4. Time on dialysis: Months _____
5. Number of years of education _____
6. Marital Status: Single ____ Married ____ Divorced ____
   Widowed ____
7. Presence of support person in patient's life
   Yes ____ No ____
8. Monthly Lab Work
   K ____ ____ ____ ____ ____ ____
   P ____ ____ ____ ____ ____ ____
   BUN ____ ____ ____ ____ ____ ____
   Bicar ____ ____ ____ ____ ____ ____

APPENDIX E

INSTRUCTIONS FOR INVITING PATIENTS INTO PHASE 1 OF STUDY

Nurses should invite each patient to participate in Phase 1 of the study as follows (You may paraphrase, but try to include all the information included below):

> Dr. Mars, the nurses here at the dialysis unit, and behavioral medicine researchers at the University of Florida are trying to better understand the problems patients have drinking the amount of liquid recommended by their doctors. As you may know, this is a big problem for many dialysis patients. With your help doctors and nurses can develop ways to help patients drink less liquid. The possible benefits of this study will be more comfortable dialysis treatments and better health for patients. To do this we need your help. We would like you to fill out a very short questionnaire, 3 times. It will take less than 5 minutes each time and can be done while you are on the machine. A nurse will help you if you'd like.
>
> In order to protect your privacy we will not write you name on the questionnaire. Instead we will write a code number on the form so we can keep track of your questionnaires. Only the Head

Nurse and 1 researcher will know the code. Will you help us by filling out the questionnaire?

If YES--Ask patient to sign written consent form for Phase 1.

If NO--Ask what the patient's objection is. Try to answer it. If the patient still declines to participate, Bill Smith will contact the patient to see if the patient can be persuaded to participate.

APPENDIX F

INSTRUCTIONS FOR INVITING PATIENTS INTO PHASE 2 OF STUDY

The patients invited to participate in Phase 2 of the project have a history of non-compliance to fluid restrictions. Many have had serious medical complications caused by fluid abuse. It is important to encourage them to participate in Phase 2 of the project. Try to present the following information in a way that maximizes the chances that the patient will agree to participate. Use the following as a guide, but feel free to paraphrase it and to invite the patient in a way that the individual patient will find most appealing.

> We wanted to thank you for helping with Phase 1 of the project. The information you gave us was very helpful. We are asking some patients to help us in another part of the project.
>
> As you know, drinking more liquid than recommended by the doctor can cause uncomfortable dialysis treatments and serious health problems. In the past you've had difficulty drinking the recommended amount of liquid. We know that you've had (fill in whatever fluid related problems that the individual patient may have had) in the past. We'd like to help you drink less liquid and avoid these problems in the future.
>
> Doctors and other health care professionals have developed some ways to help patients drink less liquid. Many patients with

difficulty drinking too much liquid have found these methods very effective in helping them drink less fluid. We feel that you could benefit from learning one of these methods. By learning one of these methods and drinking less liquid you could have more comfortable dialysis treatments and enjoy better health. Also, other patients could benefit from your experience.

If you decide to participate you would learn one of 2 methods designed to help you drink less liquid or you would be placed on a waiting list where you would learn the best method later on. Which method you will use will be decided by chance. You will learn to keep track of how much liquid you drink and the relationship between how much liquid you drink and how much weight you gain. You will use one of these methods for 2 months and then stop. After another month you could learn the best method, if you'd like. Also, we would like you to fill out the same questionnaire you did before, 3 more times.

Also, as before all information you provide us will be confidential. We will not put your name on any forms, but will use code numbers to help us keep track of your forms.

Do you have any questions? Would you participate in the project?

IF YES--Ask the person to sign a written informed consent form for Phase 2 of the study.

IF NO--Ask what the patient's objection is. Try to answer it. If the patient still declines to participate, Bill Smith will contact the patient.

APPENDIX G

SELF-MONITORING AND SELF-RECORDING INSTRUCTIONS

Using the Bottle

Use the plastic bottle we have given you to measure how much you drink. Each time you drink something, pour the same amount of water into the bottle. A good way to do this is to use the same cup or glass that you drank from.

Before you go to sleep at the end of the day, see how much water is in the bottle. Then shade that same amount on the picture of the bottle on your fluid record sheet for that day. Next, pour all of the water out of the bottle so it will be empty when you begin measuring the next day.

Measuring the liquid you drink

Starting with an empty bottle, measure how much you drink between the time you get off the dialysis machine and the time you go to sleep that night. Using a new fluid record sheet, shade in that same amount on the picture of the bottle. Then empty the bottle.

The next morning, start with an empty bottle and measure how much you drink throughout the day. Make sure you shade in that same amount on the fluid record sheet before you go to sleep that night. Remember to use a new fluid record sheet for each day. Also remember to write the date at the top of the sheet.

If the next day is NOT a dialysis day, measure how much you drink throughout the day. Before you go to sleep, make sure you shade in the

same amount on your fluid record sheet for that day. Remember to use a new fluid record sheet. Then empty the bottle.

On each day you come in for dialysis, measure how much you drink from the time you wake up to the time you come in for dialysis. Keep measuring what you drink by filling up the bottle with the same amount you drink. Before leaving home to come in for dialysis, shade in the same amount on a fluid record sheet that is in the bottle. Use a new fluid record sheet for that morning.

Other important things to remember

Each time you come in for dialysis, bring all the shaded fluid record sheets with you.

If you leave the house, try to remember how much you drink while you are away from home and put that same amount in the bottle when you get back home.

If you fill the bottle before the end of the day, shade in one whole bottle on your fluid record sheet for that day. Then, empty the bottle and continue measuring fluid each time you drink, until you go to sleep that night.

If you shade in both bottles on your fluid record sheet before the end of the day, use a new fluid record sheet for the rest of the day.

APPENDIX H

INSTRUCTIONS FOR COMPLETING THE BEHAVIORAL CONTROL GRAPH

At the top of the graph:

1. Write in the patient's name.

2. The project team will fill in the patient ID number later and remove the patient's name from the graph.

At the bottom of the graph:

3. Write in the current date.

4. Compute the patient's interdialysis weight gain. Write this number (in pounds) on the appropriate line below the graph. (Remember: 2.2 lbs = l Kilo.)

5. Divide the interdialysis weight gain by the number of days between treatments to obtain the average weight gain per day. Write this number on the appropriate line below the graph.

6. Ask the patient to give you his/her completed fluid record sheets. Calculate the total number of cups of fluid the patient drank since the previous dialysis treatment. Enter this number on the appropriate line below the graph.

7. Divide the total interdialysis fluid intake (as reported by the patient) by the number of days since the previous treatment. This gives you the average number of cups drank per day. Write this number on the appropriate line below the graph.

8. Indicate on the appropriate line below the graph whether you gave the patient praise, encouragement or no praise by circling the appropriate letter-code.

9. Write your initials (legibly, please) on the appropriate space provided below the graph.

10. Place a red adhesive dot on the graph corresponding to the patient's average weight gain per day since the previous dialysis treatment.

11. Place a blue dot on the graph corresponding to the patient's average fluid intake per day since the previous treatment.

12. Connect the dots of the same color (using a black pen).

Note: If the patient forgets to bring in his or her fluid record sheets for a particular time period:

a) Ask him or her to bring the sheets in next time they come in for dialysis (assuming they forgot to bring in the sheets as opposed to not recording their fluid intake during that time period).

b) Draw a box around the blank lines on which you would have written the total fluid intake and average fluid intake per day. If the patient later brings in the fluid intake sheets for that time period, enter the information in the boxed area.

APPENDIX I

INSTRUCTIONS FOR PRAISING PATIENTS

After completing the graph for patients in Group 2 you should do the following:

1. Tell the patient that this graph shows the relationship between the amount of liquid that the patient drank (blue dots) and the amount of weight the patient gaines (red dots).

2. The more fluid you drink the more weight you will gain. If you want to gain less weight then drink less liquid.

3. If the dots or lines connecting the lines are far apart (greater than 1 pound) tell the patients, "see how the lines are far apart; they should be close together. Perhaps, you are not measuring and recording your fluid carefully enough.

4. If the patient shows any decrease in fluid weight gain per day for the days since the last treatment, he or she is to be praised verbally. The nurse or technician graphing the fluid intake and weight gains for the patient is to praise the patient if appropriate by using phrases such as: "Way to go!" or "You did really well." or some similar phrasing. It is desirable for you to give praise enthusiastically and in a way that will appeal to that particular patient.

5. If the patient is at or below the target fluid weight gain per day of 2 pounds, then praise should be given on days when patient continues at or below 2 pounds irrespective of whether that patient maintains, gains, or decreases his or her weight gain.

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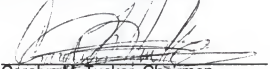
BIOGRAPHICAL SKETCH

Bill Smith received his B. S. degree in environmental sciences from the University of Wisconsin in 1975. After teaching the Transcendental Meditation Program for five years, he started graduate studies in counselor education at West Chester University in 1980. He received an M.Ed. in counseling in 1981. In 1983 he entered the counseling psychology program at the University of Florida and anticipates completing his doctoral studies in 1988. After graduation he has accepted a position as a medical psychologist at the Rehabilitation Institute of Ohio at Miami Valley Hospital in Dayton, Ohio.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.



Carolyn M. Tucker, Chairman
Associate Professor of Psychology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Robert C. Ziller
Professor of Psychology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Shae Graham Kosch
Associate Professor of Psychology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Brian A. Iwata
Professor of Psychology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

James J. Algina
Professor of Foundations of Education

This dissertation was submitted to the Graduate Faculty of the Department of Psychology in the College of Liberal Arts and Sciences and to the Graduate School and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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Dean, Graduate School